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PATENT ABSTRACTS OF JAPAN

(11)Publication number : **09-091705**

(43)Date of publication of application : **04.04.1997**

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(51)Int.Cl. G11B 7/00
G11B 7/125
G11B 19/02

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(21)Application number : **07-284447**

(22)Date of filing : **06.10.1995**

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(30)Priority

Priority number : **07200294** Priority date : **14.07.1995** Priority country : **JP**

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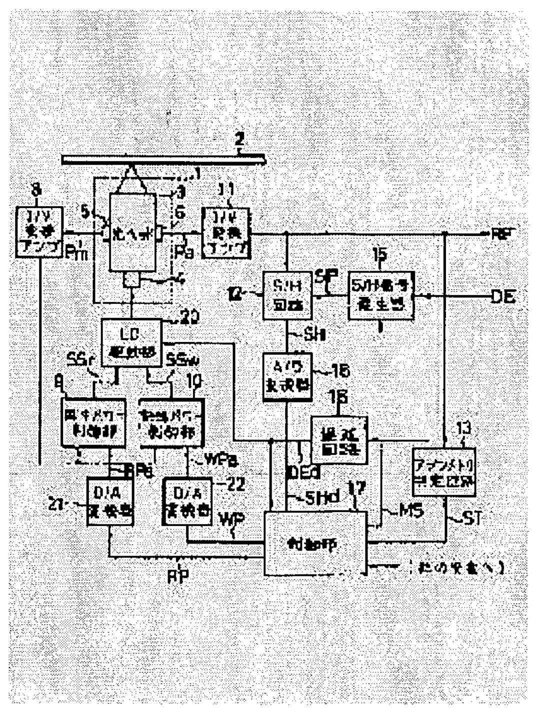
(54) POSTSCRIPT TYPE OPTICAL DISK DEVICE AND ITS CONTROL METHOD

(57)Abstract:



PROBLEM TO BE SOLVED: To improve reliability of recorded data and to stabilize recording quality by deciding the optimum recording power by trial writing before recording data and controlling actual recording power so as to be made same as this optimum recording power during recording data.

SOLUTION: Preceding actual data recording, recorded power of a laser element 4 is changed by control of a control section 7 in a test region of a disk 2, and test data is recorded. At the time of reproducing data, the optimum recording power is decided in accordance with asymmetry from an asymmetry discrimination circuit 13. At the time of recording actual data, recording is started with this optimum recording power, a recording state objective value is calculated based on a signal Pa from a light receiving element 6, after that, recording power is adjusted so that a recording state exponent calculated based on a signal Pa during recording data coincides with the recording state objective value. Thereby, reliability of recording data is improved and stable recording quality is obtained.

LEGAL STATUS

[Date of request for examination]	08.06.2000
[Date of sending the examiner's decision of rejection]	13.11.2001
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	
[Date of registration]	
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The record power control means which controls the record power of the semiconductor laser component of the light source on a multistage story, It has a reflected light detection means to detect the reflected light from the optical disk at the time of record, and an asymmetry detection means to detect the asymmetry of the regenerative signal from an optical disk. In the write once optical disk equipment which distinguishes the data-logging condition over an optical disk based on the detecting signal of the above-mentioned reflected light detection means at the time of record In advance of actual data logging, to the test field set as the predetermined field of an optical disk When the test data which recorded the test data and was recorded for every record power is reproduced changing record power to a multistage story by the above-mentioned record power control means According to the asymmetry which the above-mentioned asymmetry detection means detected, the optimal record power at the time of data logging is determined. The inside of actual data logging Start data logging by the above-mentioned optimal record power, and record condition desired value is computed based on the detecting signal of the above-mentioned reflected light detection means immediately after data-logging initiation. Write once optical disk equipment characterized by adjusting the record power of the above-mentioned record power control means so that the record condition characteristic computed based on the detecting signal of the above-mentioned reflected light detection means may be in agreement with the above-mentioned record condition desired value after it.
[Claim 2] The record power control means which controls the record power of the semiconductor laser component of the light source on a multistage story, It has a reflected light detection means to detect the reflected light from the optical disk at the time of record, and an asymmetry detection means to detect the asymmetry of the regenerative signal from an optical disk. In the write once optical disk equipment which distinguishes the data-logging condition over an optical disk based on the detecting signal of the above-mentioned reflected light detection means at the time of record In advance of actual data logging, to the test field set as the predetermined field of an optical disk When the test data which recorded the test data and was recorded for every record power is reproduced changing record power to a multistage story by the above-mentioned record power control means According to the asymmetry which the above-mentioned asymmetry detection means detected, the optimal record power at the time of data logging is determined. The inside of actual data logging Start data logging by the above-mentioned optimal record power, and record condition desired value is computed based on two or more detecting signals immediately after data-logging initiation obtained from the above-mentioned reflected light detection means at least throughout [1 rotation term / of an optical disk]. Write once optical disk equipment characterized by adjusting the record power of the above-mentioned record power control means so that the record condition characteristic computed based on the detecting signal of the above-mentioned reflected light detection means may be in agreement with the above-mentioned record condition desired value after it.
[Claim 3] Calculation of said record condition characteristic in data logging is write once optical disk equipment according to claim 2 characterized by carrying out based on two or more detecting signals

obtained from said reflected light detection means at least throughout [1 rotation term / of an optical disk].

[Claim 4] The record power control means which controls the record power of the semiconductor laser component of the light source on a multistage story, It has a reflected light detection means to detect the reflected light from the optical disk at the time of record, and an asymmetry detection means to detect the asymmetry of the regenerative signal from an optical disk. In the write once optical disk equipment which distinguishes the data-logging condition over an optical disk based on the detecting signal of the above-mentioned reflected light detection means at the time of record It has a defective detection means to detect the defect produced in the optical disk based on the regenerative signal from an optical disk. In advance of actual data logging, to the test field set as the predetermined field of an optical disk When the test data which recorded the test data and was recorded for every record power is reproduced changing record power to a multistage story by the above-mentioned record power control means According to the asymmetry which the above-mentioned asymmetry detection means detected, the optimal record power at the time of data logging is determined. The inside of actual data logging The inside of the detecting signal which starts data logging by the above-mentioned optimal record power, and is obtained from the above-mentioned reflected light detection means immediately after data-logging initiation, Record condition desired value is computed based on the detecting signal of predetermined numbers other than what was obtained while the above-mentioned defective detection means detected the defect. Write once optical disk equipment characterized by adjusting the record power of the above-mentioned record power control means so that the record condition characteristic computed based on the detecting signal of the above-mentioned reflected light detection means may be in agreement with the above-mentioned record condition desired value after it.

[Claim 5] Calculation of said record condition characteristic in data logging is write once optical disk equipment according to claim 4 characterized by carrying out based on the detecting signal of predetermined numbers other than what was obtained while said defective detection means detected the defect among the detecting signals obtained from said reflected light detection means.

[Claim 6] The photo detector to which said reflected light detection means detects a reflected light signal, and the sample hold circuit which samples the light-receiving signal of the above-mentioned photo detector, It has the sample hold signal generation circuit which changes the generating timing of the sampling signal of the above-mentioned sample hold circuit. The generating timing of the sampling signal of the above-mentioned sample hold circuit is changed by the above-mentioned sample hold signal generation circuit immediately after data-logging initiation. To the generating timing of the above-mentioned sampling signal which detected the changing point of the signal outputted from the above-mentioned sample hold circuit Claim 1 characterized by setting up the generating timing of the sampling signal of the above-mentioned sample hold circuit, claim 2, or write once optical disk equipment according to claim 3, 4, or 5.

[Claim 7] Said reflected light detection means is claim 1 characterized by adjusting the gain of the above-mentioned variable gain amplifier so that it may have the photo detector which detects a reflected light signal, the variable gain amplifier which amplifies the light-receiving signal of the above-mentioned photo detector, and the analog-to-digital converter which changes the output signal of the above-mentioned variable gain amplifier into a digital signal and the output of the above-mentioned variable gain amplifier may become the value of the predetermined range immediately after data-logging initiation, claim 2, or write once optical disk equipment according to claim 3, 4, or 5.

[Claim 8] The record power control means which controls the record power of the semiconductor laser component of the light source on a multistage story, It has a reflected light detection means to detect the reflected light from the optical disk at the time of record, and an asymmetry detection means to detect the asymmetry of the regenerative signal from an optical disk. In the write once optical disk equipment which distinguishes the data-logging condition over an optical disk based on the detecting signal of the above-mentioned reflected light detection means at the time of record In advance of actual data logging, to the test field set as the predetermined field of an optical disk When the test data which recorded the test data and was recorded for every record power is reproduced changing record power to a multistage

story by the above-mentioned record power control means While setting the record power from which the asymmetry which the above-mentioned asymmetry detection means detected becomes min as the optimal record power at the time of data logging The characteristic showing the rate of the detecting signal of the above-mentioned reflected light detection means to record power When the existence of monotonicity which is changing in monotone according to change of record power is investigated and the above-mentioned monotonicity is judged to be **** The inside of actual data logging starts data logging by the above-mentioned optimal record power. So that record condition desired value may be computed based on the detecting signal of the above-mentioned reflected light detection means immediately after data-logging initiation and the record condition characteristic computed based on the detecting signal of the above-mentioned reflected light detection means may be in agreement with the above-mentioned record condition desired value after it The inside of data logging actual when it is judged that the record power of the above-mentioned record power control means is adjusted, and there is no above-mentioned monotonicity is write once optical disk equipment characterized by holding and carrying out data logging of the above-mentioned optimal record power.

[Claim 9] The record power control means which controls the record power of the semiconductor laser component of the light source on a multistage story, It has a reflected light detection means to detect the reflected light from the optical disk at the time of record, and an asymmetry detection means to detect the asymmetry of the regenerative signal from an optical disk. In the write once optical disk equipment which distinguishes the data-logging condition over an optical disk based on the detecting signal of the above-mentioned reflected light detection means at the time of record In advance of actual data logging, to the test field set as the predetermined field of an optical disk When the test data which recorded the test data and was recorded for every record power is reproduced changing record power to a multistage story by the above-mentioned record power control means While setting the record power from which the asymmetry which the above-mentioned asymmetry detection means detected becomes min as the optimal record power at the time of data logging The characteristic showing the rate of the detecting signal of the above-mentioned reflected light detection means to record power When the existence of monotonicity which is changing in monotone according to change of record power is investigated and the above-mentioned monotonicity is judged to be **** The inside of actual data logging starts data logging by the above-mentioned optimal record power. Record condition desired value is computed based on two or more detecting signals immediately after data-logging initiation obtained from the above-mentioned reflected light detection means at least throughout [1 rotation term / of an optical disk]. So that the record condition characteristic computed based on the detecting signal of the above-mentioned reflected light detection means may be in agreement with the above-mentioned record condition desired value after it The inside of data logging actual when it is judged that the record power of the above-mentioned record power control means is adjusted, and there is no above-mentioned monotonicity is write once optical disk equipment characterized by holding and carrying out data logging of the above-mentioned optimal record power.

[Claim 10] The record power control means which controls the record power of the semiconductor laser component of the light source on a multistage story, It has a reflected light detection means to detect the reflected light from the optical disk at the time of record, and an asymmetry detection means to detect the asymmetry of the regenerative signal from an optical disk. In the write once optical disk equipment which distinguishes the data-logging condition over an optical disk based on the detecting signal of the above-mentioned reflected light detection means at the time of record It has a defective detection means to detect the defect produced in the optical disk based on the regenerative signal from an optical disk. In advance of actual data logging, to the test field set as the predetermined field of an optical disk When the test data which recorded the test data and was recorded for every record power is reproduced changing record power to a multistage story by the above-mentioned record power control means While setting the record power from which the asymmetry which the above-mentioned asymmetry detection means detected becomes min as the optimal record power at the time of data logging The characteristic showing the rate of the detecting signal of the above-mentioned reflected light detection means to record power When the existence of monotonicity which is changing in monotone according to change of

record power is investigated and the above-mentioned monotonicity is judged to be **** The inside of actual data logging starts data logging by the above-mentioned optimal record power. The inside of the detecting signal obtained from the above-mentioned reflected light detection means immediately after data-logging initiation, Record condition desired value is computed based on the detecting signal of predetermined numbers other than what was obtained while the above-mentioned defective detection means detected the defect. So that the record condition characteristic computed based on the detecting signal of the above-mentioned reflected light detection means may be in agreement with the above-mentioned record condition desired value after it The inside of data logging actual when it is judged that the record power of the above-mentioned record power control means is adjusted, and there is no above-mentioned monotonicity is write once optical disk equipment characterized by holding and carrying out data logging of the above-mentioned optimal record power.
[Claim 11] Change of said record power is claim 1 characterized by restricting within the limits of predetermined, claim 2, claim 3, claim 4, claim 5, claim 6, claim 7, or write once optical disk equipment according to claim 8, 9, or 10.
[Claim 12] The limit range of said record power is write once optical disk equipment according to claim 11 characterized by setting up based on the temperature change of the time of computing a record condition characteristic after setting up said optimal record power.
[Claim 13] In the control approach of the write once optical disk equipment which distinguishes the data-logging condition over an optical disk based on the magnitude of the reflected light at the time of record When the test data which recorded the test data on the test field set as the predetermined field of an optical disk, changing record power to a multistage story, and was recorded on it for every record power is reproduced in advance of actual data logging According to the asymmetry of the regenerative signal, the optimal record power at the time of data logging is determined. The inside of actual data logging Start data logging by the above-mentioned optimal record power, and record condition desired value is computed based on the reflected light from the optical disk detected immediately after data-logging initiation. The control approach of the write once optical disk equipment characterized by adjusting record power so that a record condition characteristic may be computed from an optical disk after it based on the reflected light to proper timing and the computed record condition characteristic may be in agreement with the above-mentioned record condition desired value.
[Claim 14] In the control approach of the write once optical disk equipment which distinguishes the data-logging condition over an optical disk based on the magnitude of the reflected light at the time of record When the test data which recorded the test data on the test field set as the predetermined field of an optical disk, changing record power to a multistage story, and was recorded on it for every record power is reproduced in advance of actual data logging According to the asymmetry of the regenerative signal, the optimal record power at the time of data logging is determined. The inside of actual data logging Start data logging by the above-mentioned optimal record power, and record condition desired value is computed based on the reflected light from the optical disk immediately after data-logging initiation detected at least throughout [1 rotation term / of an optical disk]. The control approach of the write once optical disk equipment characterized by adjusting record power so that the record condition characteristic computed based on the reflected light from an optical disk may be in agreement with the above-mentioned record condition desired value after it.
[Claim 15] In the control approach of the write once optical disk equipment which distinguishes the data-logging condition over an optical disk based on the magnitude of the reflected light at the time of record When the test data which recorded the test data on the test field set as the predetermined field of an optical disk, changing record power to a multistage story, and was recorded on it for every record power is reproduced in advance of actual data logging According to the asymmetry of the regenerative signal, the optimal record power at the time of data logging is determined. The inside of actual data logging Data logging is started by the above-mentioned optimal record power. Immediately after data-logging initiation So that record condition desired value may be computed based on the reflected light from the optical disk obtained from the field without a defect and the record condition characteristic computed based on the reflected light from an optical disk may be in agreement with the above-

mentioned record condition desired value after it The control approach of the write once optical disk equipment characterized by adjusting record power.
[Claim 16] In the control approach of the write once optical disk equipment which distinguishes the data-logging condition over an optical disk based on the magnitude of the reflected light at the time of record When the test data which recorded the test data on the test field set as the predetermined field of an optical disk, changing record power to a multistage story, and was recorded on it for every record power is reproduced in advance of actual data logging While setting the record power from which the asymmetry of the regenerative signal becomes min as the optimal record power at the time of data logging The characteristic showing the rate of the detecting signal of the above-mentioned reflected light detection means to record power When the existence of monotonicity which is changing in monotone according to change of record power is investigated and the above-mentioned monotonicity is judged to be **** The inside of actual data logging starts data logging by the above-mentioned optimal record power. Based on the reflected light, record condition desired value is computed from the optical disk detected immediately after data-logging initiation. So that a record condition characteristic may be computed from an optical disk after it based on the reflected light to proper timing and the computed record condition characteristic may be in agreement with the above-mentioned record condition desired value The inside of data logging actual when it is judged that record power is adjusted and there is no above-mentioned monotonicity is the control approach of the write once optical disk equipment characterized by holding and carrying out data logging of the above-mentioned optimal record power.
[Claim 17] In the control approach of the write once optical disk equipment which distinguishes the data-logging condition over an optical disk based on the magnitude of the reflected light at the time of record When the test data which recorded the test data on the test field set as the predetermined field of an optical disk, changing record power to a multistage story, and was recorded on it for every record power is reproduced in advance of actual data logging While setting the record power from which the asymmetry of the regenerative signal becomes min as the optimal record power at the time of data logging The characteristic showing the rate of the detecting signal of the above-mentioned reflected light detection means to record power When the existence of monotonicity which is changing in monotone according to change of record power is investigated and the above-mentioned monotonicity is judged to be **** The inside of actual data logging starts data logging by the above-mentioned optimal record power. Record condition desired value is computed based on the reflected light from the optical disk immediately after data-logging initiation detected at least throughout [1 rotation term / of an optical disk]. When it is judged that record power is adjusted and there is no above-mentioned monotonicity so that the record condition characteristic computed based on the reflected light from an optical disk may be in agreement with the above-mentioned record condition desired value after it The inside of actual data logging is the control approach of the write once optical disk equipment characterized by holding and carrying out data logging of the above-mentioned optimal record power.
[Claim 18] In the control approach of the write once optical disk equipment which distinguishes the data-logging condition over an optical disk based on the magnitude of the reflected light at the time of record When the test data which recorded the test data on the test field set as the predetermined field of an optical disk, changing record power to a multistage story, and was recorded on it for every record power is reproduced in advance of actual data logging While setting the record power from which the asymmetry of the regenerative signal becomes min as the optimal record power at the time of data logging The characteristic showing the rate of the detecting signal of the above-mentioned reflected light detection means to record power When the existence of monotonicity which is changing in monotone according to change of record power is investigated and the above-mentioned monotonicity is judged to be **** The inside of actual data logging starts data logging by the above-mentioned optimal record power. So that the record condition characteristic which computed record condition desired value based on the reflected light from the optical disk obtained from the field without a defect, and was computed after it immediately after data-logging initiation based on the reflected light from an optical disk may be in agreement with the above-mentioned record condition desired value The inside of data logging actual when it is judged that record power is adjusted and there is no above-mentioned monotonicity is the

control approach of the write once optical disk equipment characterized by holding and carrying out data logging of the above-mentioned optimal record power.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention is equipped with the record power control means which controls the record power of the semiconductor laser component of the light source on a multistage story, a reflected light detection means detect the reflected light from the optical disk at the time of record, and an asymmetry detection means detect the asymmetry of the regenerative signal from an optical disk, and relates to the write once optical disk equipment which distinguishes the data-logging condition over an optical disk, and its control approach based on the detecting signal of the above-mentioned reflected light detection means at the time of record.
[0002]
[Description of the Prior Art] Generally, since information could not record certainly when recording data on a write once optical disk, and the power of a laser beam was changed, the power at the time of record was controlled by write once optical disk equipment using a write once optical disk (for example, a WORM mold optical disk or CD-R (CD which can be written in (compact disc))) as a storage so that the reinforcement of a laser beam became fixed.
[0003] However, according to a cause as shown below, even if the reinforcement of a laser beam is fixed, the optimal pit configuration cannot be acquired. In addition, a pit (stoma) expresses the recording information formed in a write once optical disk.
[0004] - Change of the recording characteristic by wavelength change of the semiconductor laser component (light source component) by change and the temperature change of the property of the record medium by change and temperature changes, such as an inclination of the record medium to dispersion and optical system of the property of a record medium, [0005] Then, although indicated by the former, for example, JP,6-76288,A, like, a change of the reflected light from the record medium of a laser beam on the strength is detected at the time of record, and what is going to acquire the optimal pit configuration by changing the reinforcement of the laser beam which irradiates a record medium is proposed.
[0006] The following procedures are adopted by this conventional approach.
[0007] (i) A test data is recorded in the test field on a record medium (trying and writing field), changing the reinforcement of a laser beam. At this time, the reflected light reinforcement from a record medium is measured and memorized to coincidence. Moreover, reflected light reinforcement measures a thing the time (recording level (or pit level)) when the laser power at the time of pit formation is strong, and when laser power is weak (land level) if needed.
[0008] (ii) From the reflected light on-the-strength measurement result when recording by the laser beam to which asymmetry becomes the smallest, the desired value M of reflected light reinforcement is defined.
[0009] (iii) Reflected light reinforcement is measured recording actual data on a record medium, and the reinforcement of a laser beam is changed so that the value may be in agreement with desired value M.
[0010] It is the value calculated by the following formula (I) here using the amplitude value A by the

side of plus, and the amplitude value B by the side of minus from the zero level of the amplitude of the regenerative signal when reproducing record data as asymmetry as shown in drawing 26 .
[0011]
(Asymmetry) =((B-A)/(B+A)) (/2) x100 (%)
... (I)
[0012] When asymmetry is small, it is a case with the good wave of a regenerative signal, and the stability of the processing when extracting data from a regenerative signal becomes [the difference of the amplitude value by the side of plus of a regenerative signal, and the amplitude value by the side of minus] few therefore good. Moreover, JP,6-76288,A is indicated that the optimum value of asymmetry is a value of -4-7(%).
[0013]
[Problem(s) to be Solved by the Invention] However, to equipment, it had produced following un-arranging such conventionally.
[0014] That is, conventionally, with equipment, since the test data was recorded on the test field, reflected light reinforcement was detected only at the time of data logging in the test field and it was made into desired value, the measurement count of reflected light reinforcement is limited, desired value M cannot be defined correctly, but it produces un-arranging [that a measurement result becomes unstable].
[0015] Moreover, in order to obtain many data in a short test field, a high-speed analog-to-digital converter is required, and since it needs a sample hold circuit and two analog-to-digital converters like equipment before especially in [that was mentioned above] asking for pit level and land level if needed, respectively, it also produces un-arranging [that equipment cost becomes high].
[0016] This invention is made in view of this actual condition, and aims at the stability of data logging offering good and cheap write once optical disk equipment and its control approach.
[0017]
[Means for Solving the Problem] The record power control means by which this invention controls the record power of the semiconductor laser component of the light source on a multistage story, It has a reflected light detection means to detect the reflected light from the optical disk at the time of record, and an asymmetry detection means to detect the asymmetry of the regenerative signal from an optical disk. In the write once optical disk equipment which distinguishes the data-logging condition over an optical disk based on the detecting signal of the above-mentioned reflected light detection means at the time of record In advance of actual data logging, to the test field set as the predetermined field of an optical disk When the test data which recorded the test data and was recorded for every record power is reproduced changing record power to a multistage story by the above-mentioned record power control means According to the asymmetry which the above-mentioned asymmetry detection means detected, the optimal record power at the time of data logging is determined. The inside of actual data logging Start data logging by the above-mentioned optimal record power, and record condition desired value is computed based on the detecting signal of the above-mentioned reflected light detection means immediately after data-logging initiation. The record power of the above-mentioned record power control means is adjusted so that the record condition characteristic computed based on the detecting signal of the above-mentioned reflected light detection means may be in agreement with the above-mentioned record condition desired value after it. Moreover, the record power control means which controls the record power of the semiconductor laser component of the light source on a multistage story, It has a reflected light detection means to detect the reflected light from the optical disk at the time of record, and an asymmetry detection means to detect the asymmetry of the regenerative signal from an optical disk. In the write once optical disk equipment which distinguishes the data-logging condition over an optical disk based on the detecting signal of the above-mentioned reflected light detection means at the time of record In advance of actual data logging, to the test field set as the predetermined field of an optical disk When the test data which recorded the test data and was recorded for every record power is reproduced changing record power to a multistage story by the above-mentioned record power control means According to the asymmetry which the above-mentioned asymmetry detection means detected,

the optimal record power at the time of data logging is determined. The inside of actual data logging Start data logging by the above-mentioned optimal record power, and record condition desired value is computed based on two or more detecting signals immediately after data-logging initiation obtained from the above-mentioned reflected light detection means at least throughout [1 rotation term / of an optical disk]. The record power of the above-mentioned record power control means is adjusted so that the record condition characteristic computed based on the detecting signal of the above-mentioned reflected light detection means may be in agreement with the above-mentioned record condition desired value after it. Moreover, calculation of said record condition characteristic in data logging is good to carry out based on two or more detecting signals obtained from said reflected light detection means at least throughout [1 rotation term / of an optical disk].

[0018] Moreover, the record power control means which controls the record power of the semiconductor laser component of the light source on a multistage story, It has a reflected light detection means to detect the reflected light from the optical disk at the time of record, and an asymmetry detection means to detect the asymmetry of the regenerative signal from an optical disk. In the write once optical disk equipment which distinguishes the data-logging condition over an optical disk based on the detecting signal of the above-mentioned reflected light detection means at the time of record It has a defective detection means to detect the defect produced in the optical disk based on the regenerative signal from an optical disk. In advance of actual data logging, to the test field set as the predetermined field of an optical disk When the test data which recorded the test data and was recorded for every record power is reproduced changing record power to a multistage story by the above-mentioned record power control means According to the asymmetry which the above-mentioned asymmetry detection means detected, the optimal record power at the time of data logging is determined. The inside of actual data logging The inside of the detecting signal which starts data logging by the above-mentioned optimal record power, and is obtained from the above-mentioned reflected light detection means immediately after data-logging initiation, Record condition desired value is computed based on the detecting signal of predetermined numbers other than what was obtained while the above-mentioned defective detection means detected the defect. The record power of the above-mentioned record power control means is adjusted so that the record condition characteristic computed based on the detecting signal of the above-mentioned reflected light detection means may be in agreement with the above-mentioned record condition desired value after it. Moreover, calculation of said record condition characteristic in data logging is good to carry out based on the detecting signal of predetermined numbers other than what was obtained while said defective detection means detected the defect among the detecting signals obtained from said reflected light detection means.

[0019] Moreover, the photo detector to which said reflected light detection means detects a reflected light signal and the sample hold circuit which samples the light-receiving signal of the above-mentioned photo detector, It has the sample hold signal generation circuit which changes the generating timing of the sampling signal of the above-mentioned sample hold circuit. The generating timing of the sampling signal of the above-mentioned sample hold circuit is changed by the above-mentioned sample hold signal generation circuit immediately after data-logging initiation. The generating timing of the sampling signal of the above-mentioned sample hold circuit is set as the generating timing of the above-mentioned sampling signal which detected the changing point of the signal outputted from the above-mentioned sample hold circuit.

[0020] Moreover, said reflected light detection means is equipped with the photo detector which detects a reflected light signal, the variable gain amplifier which amplifies the light-receiving signal of the above-mentioned photo detector, and the analog-to-digital converter which changes the output signal of the above-mentioned variable gain amplifier into a digital signal, and it adjusts the gain of the above-mentioned variable gain amplifier so that the output of the above-mentioned variable gain amplifier may become the value of the predetermined range immediately after data-logging initiation.

[0021] Moreover, the record power control means which controls the record power of the semiconductor laser component of the light source on a multistage story, It has a reflected light detection means to detect the reflected light from the optical disk at the time of record, and an asymmetry detection means

to detect the asymmetry of the regenerative signal from an optical disk. In the write once optical disk equipment which distinguishes the data-logging condition over an optical disk based on the detecting signal of the above-mentioned reflected light detection means at the time of record In advance of actual data logging, to the test field set as the predetermined field of an optical disk When the test data which recorded the test data and was recorded for every record power is reproduced changing record power to a multistage story by the above-mentioned record power control means While setting the record power from which the asymmetry which the above-mentioned asymmetry detection means detected becomes min as the optimal record power at the time of data logging The characteristic showing the rate of the detecting signal of the above-mentioned reflected light detection means to record power When the existence of monotonicity which is changing in monotone according to change of record power is investigated and the above-mentioned monotonicity is judged to be **** The inside of actual data logging starts data logging by the above-mentioned optimal record power. So that record condition desired value may be computed based on the detecting signal of the above-mentioned reflected light detection means immediately after data-logging initiation and the record condition characteristic computed based on the detecting signal of the above-mentioned reflected light detection means may be in agreement with the above-mentioned record condition desired value after it The record power of the above-mentioned record power control means is adjusted, and when it is judged that there is no above-mentioned monotonicity, the inside of actual data logging holds the above-mentioned optimal record power, and it is made to carry out data logging.

[0022] Moreover, the record power control means which controls the record power of the semiconductor laser component of the light source on a multistage story, It has a reflected light detection means to detect the reflected light from the optical disk at the time of record, and an asymmetry detection means to detect the asymmetry of the regenerative signal from an optical disk. In the write once optical disk equipment which distinguishes the data-logging condition over an optical disk based on the detecting signal of the above-mentioned reflected light detection means at the time of record In advance of actual data logging, to the test field set as the predetermined field of an optical disk When the test data which recorded the test data and was recorded for every record power is reproduced changing record power to a multistage story by the above-mentioned record power control means While setting the record power from which the asymmetry which the above-mentioned asymmetry detection means detected becomes min as the optimal record power at the time of data logging The characteristic showing the rate of the detecting signal of the above-mentioned reflected light detection means to record power When the existence of monotonicity which is changing in monotone according to change of record power is investigated and the above-mentioned monotonicity is judged to be **** The inside of actual data logging starts data logging by the above-mentioned optimal record power. Record condition desired value is computed based on two or more detecting signals immediately after data-logging initiation obtained from the above-mentioned reflected light detection means at least throughout [1 rotation term / of an optical disk]. So that the record condition characteristic computed based on the detecting signal of the above-mentioned reflected light detection means may be in agreement with the above-mentioned record condition desired value after it The record power of the above-mentioned record power control means is adjusted, and when it is judged that there is no above-mentioned monotonicity, the inside of actual data logging holds the above-mentioned optimal record power, and it is made to carry out data logging.

[0023] Moreover, the record power control means which controls the record power of the semiconductor laser component of the light source on a multistage story, It has a reflected light detection means to detect the reflected light from the optical disk at the time of record, and an asymmetry detection means to detect the asymmetry of the regenerative signal from an optical disk. In the write once optical disk equipment which distinguishes the data-logging condition over an optical disk based on the detecting signal of the above-mentioned reflected light detection means at the time of record It has a defective detection means to detect the defect produced in the optical disk based on the regenerative signal from an optical disk. In advance of actual data logging, to the test field set as the predetermined field of an optical disk When the test data which recorded the test data and was recorded for every record power is

reproduced changing record power to a multistage story by the above-mentioned record power control means While setting the record power from which the asymmetry which the above-mentioned asymmetry detection means detected becomes min as the optimal record power at the time of data logging The characteristic showing the rate of the detecting signal of the above-mentioned reflected light detection means to record power When the existence of monotonicity which is changing in monotone according to change of record power is investigated and the above-mentioned monotonicity is judged to be **** The inside of actual data logging starts data logging by the above-mentioned optimal record power. The inside of the detecting signal obtained from the above-mentioned reflected light detection means immediately after data-logging initiation, Record condition desired value is computed based on the detecting signal of predetermined numbers other than what was obtained while the above-mentioned defective detection means detected the defect. So that the record condition characteristic computed based on the detecting signal of the above-mentioned reflected light detection means may be in agreement with the above-mentioned record condition desired value after it The record power of the above-mentioned record power control means is adjusted, and when it is judged that there is no above-mentioned monotonicity, the inside of actual data logging holds the above-mentioned optimal record power, and it is made to carry out data logging. Moreover, change of said record power is good to make it restrict within the limits of predetermined. Moreover, after the limit range of said record power sets up said optimal record power, it is good to set up based on the temperature change of the time of computing a record condition characteristic.

[0024] Moreover, based on the magnitude of the reflected light at the time of record, it sets to the control approach of the write once optical disk equipment which distinguishes the data-logging condition over an optical disk. When the test data which recorded the test data on the test field set as the predetermined field of an optical disk, changing record power to a multistage story, and was recorded on it for every record power is reproduced in advance of actual data logging According to the asymmetry of the regenerative signal, the optimal record power at the time of data logging is determined. The inside of actual data logging Start data logging by the above-mentioned optimal record power, and record condition desired value is computed based on the reflected light from the optical disk detected immediately after data-logging initiation. Based on the reflected light, a record condition characteristic is computed from an optical disk after it to proper timing, and record power is adjusted so that the computed record condition characteristic may be in agreement with the above-mentioned record condition desired value.

[0025] Moreover, based on the magnitude of the reflected light at the time of record, it sets to the control approach of the write once optical disk equipment which distinguishes the data-logging condition over an optical disk. When the test data which recorded the test data on the test field set as the predetermined field of an optical disk, changing record power to a multistage story, and was recorded on it for every record power is reproduced in advance of actual data logging According to the asymmetry of the regenerative signal, the optimal record power at the time of data logging is determined. The inside of actual data logging Start data logging by the above-mentioned optimal record power, and record condition desired value is computed based on the reflected light from the optical disk immediately after data-logging initiation detected at least throughout [1 rotation term / of an optical disk]. Record power is adjusted so that the record condition characteristic computed based on the reflected light from an optical disk may be in agreement with the above-mentioned record condition desired value after it.

[0026] Moreover, based on the magnitude of the reflected light at the time of record, it sets to the control approach of the write once optical disk equipment which distinguishes the data-logging condition over an optical disk. When the test data which recorded the test data on the test field set as the predetermined field of an optical disk, changing record power to a multistage story, and was recorded on it for every record power is reproduced in advance of actual data logging According to the asymmetry of the regenerative signal, the optimal record power at the time of data logging is determined. The inside of actual data logging Data logging is started by the above-mentioned optimal record power. Immediately after data-logging initiation Record condition desired value is computed based on the reflected light from the optical disk obtained from the field without a defect, and after it, record power is adjusted so

that the record condition characteristic computed based on the reflected light from an optical disk may be in agreement with the above-mentioned record condition desired value.

[0027] Moreover, based on the magnitude of the reflected light at the time of record, it sets to the control approach of the write once optical disk equipment which distinguishes the data-logging condition over an optical disk. When the test data which recorded the test data on the test field set as the predetermined field of an optical disk, changing record power to a multistage story, and was recorded on it for every record power is reproduced in advance of actual data logging While setting the record power from which the asymmetry of the regenerative signal becomes min as the optimal record power at the time of data logging The characteristic showing the rate of the detecting signal of the above-mentioned reflected light detection means to record power When the existence of monotonicity which is changing in monotone according to change of record power is investigated and the above-mentioned monotonicity is judged to be **** The inside of actual data logging starts data logging by the above-mentioned optimal record power. Based on the reflected light, record condition desired value is computed from the optical disk detected immediately after data-logging initiation. So that a record condition characteristic may be computed from an optical disk after it based on the reflected light to proper timing and the computed record condition characteristic may be in agreement with the above-mentioned record condition desired value Record power is adjusted, and when it is judged that there is no above-mentioned monotonicity, the inside of actual data logging holds the above-mentioned optimal record power, and it is made to carry out data logging.

[0028] Moreover, based on the magnitude of the reflected light at the time of record, it sets to the control approach of the write once optical disk equipment which distinguishes the data-logging condition over an optical disk. When the test data which recorded the test data on the test field set as the predetermined field of an optical disk, changing record power to a multistage story, and was recorded on it for every record power is reproduced in advance of actual data logging While setting the record power from which the asymmetry of the regenerative signal becomes min as the optimal record power at the time of data logging The characteristic showing the rate of the detecting signal of the above-mentioned reflected light detection means to record power When the existence of monotonicity which is changing in monotone according to change of record power is investigated and the above-mentioned monotonicity is judged to be **** The inside of actual data logging starts data logging by the above-mentioned optimal record power. Record condition desired value is computed based on the reflected light from the optical disk immediately after data-logging initiation detected at least throughout [1 rotation term / of an optical disk]. When it is judged that record power is adjusted and there is no above-mentioned monotonicity so that the record condition characteristic computed based on the reflected light from an optical disk may be in agreement with the above-mentioned record condition desired value after it The inside of actual data logging holds the above-mentioned optimal record power, and it is made to carry out data logging.

[0029] Moreover, based on the magnitude of the reflected light at the time of record, it sets to the control approach of the write once optical disk equipment which distinguishes the data-logging condition over an optical disk. When the test data which recorded the test data on the test field set as the predetermined field of an optical disk, changing record power to a multistage story, and was recorded on it for every record power is reproduced in advance of actual data logging While setting the record power from which the asymmetry of the regenerative signal becomes min as the optimal record power at the time of data logging The characteristic showing the rate of the detecting signal of the above-mentioned reflected light detection means to record power When the existence of monotonicity which is changing in monotone according to change of record power is investigated and the above-mentioned monotonicity is judged to be **** The inside of actual data logging starts data logging by the above-mentioned optimal record power. So that the record condition characteristic which computed record condition desired value based on the reflected light from the optical disk obtained from the field without a defect, and was computed after it immediately after data-logging initiation based on the reflected light from an optical disk may be in agreement with the above-mentioned record condition desired value Record power is adjusted, and when it is judged that there is no above-mentioned monotonicity, the inside of actual data logging holds the above-mentioned optimal record power, and it is made to carry out data logging.

[0030]
[Embodiment of the Invention] Hereafter, the example of this invention is explained to a detail, referring to an accompanying drawing.
[0031] Drawing 1 shows the important section of the write once optical disk equipment concerning one example of this invention.
[0032] In this drawing, optical pickup equipment 1 is for reproducing data from a write once optical disk 2, while recording data on a write once optical disk 2, and the photo detector 6 for signal detection for detecting the photo detector 5 for output monitors for detecting the output level of the semiconductor laser component 4 used as the light source and the semiconductor laser component 4 and the reflected light from a write once optical disk 2 is formed in the optical head 3. In addition, the tracking control means (illustration abbreviation) for making the laser beam of the focusing control means (illustration abbreviation) for uniting a focus with a recording track for the laser beam of the optical head 3 or an optical head follow a recording track etc. is attached to optical pickup equipment 1. Moreover, the seeking device (illustration abbreviation) which carries out both-way migration of the optical head 3 radial [of a write once optical disk 2] is also prepared in optical pickup equipment 1.
[0033] After the monitor light-receiving signal Pm outputted from the photo detector 5 for output monitors is changed into a voltage signal through a current / electrical-potential-difference conversion amplifier 8, it is added to the playback power control section 9 and the record power control section 10.
[0034] It is outputted to next step equipment as a regenerative signal RF while it is added to a sample / hold circuit 12, and the asymmetry judging circuit 13, after the signal light-receiving signal Pa outputted from the photo detector 6 for signal detection is changed into a voltage signal through a current / electrical-potential-difference conversion amplifier 11.
[0035] The record data DE which are added from a well-known record data generating means (illustration abbreviation) and by which the EFM (Eight to Fourteen Modulation) modulation was carried out are added to the sample hold signal generator 15 and the delay circuit 16.
[0036] The sample hold signal generator 15 is a mode according to mode signal MS added from a control section 17, the sampling signal SP is outputted to the timing which has gone through the predetermined sampling time from the standup timing of the record data DE, and the sampling signal SP is added to the sample / hold circuit 12.
[0037] Thereby, a sample / hold circuit 12 samples the signal added to the timing (for example, rising edge of the sampling signal SP) to which the sampling signal SP is added, and outputs it to an analog-to-digital converter 18 by making the sampling result into the sample hold value SH.
[0038] An analog-to-digital converter 18 changes the sample hold value SH applied into a corresponding digital signal, and the output signal is applied to the control section 17 as a sample hold value SHd.
[0039] A delay circuit 16 delays the record data DE added predetermined delay time, and the output signal is applied to the control section 17 and LD (semiconductor laser component) drive circuit 20 as record data DEd.
[0040] A control section 17 controls actuation of this write once optical disk equipment, forms the control signal RP for specifying the output at the time of playback of the semiconductor laser component 4, and the control signal WP which specifies the output at the time of record of the semiconductor laser component 4, and outputs these control signals RP and a control signal WP to a digital to analog converter 21 and a digital to analog converter 22, respectively.
[0041] A digital to analog converter 21 changes the control signal RP added into a corresponding analog signal, and the output signal is applied to the playback power control section 9 as a control signal RPa.
[0042] A digital to analog converter 22 changes the control signal WP added into a corresponding analog signal, and the output signal is applied to the record power control section 10 as a control signal WPa.
[0043] The playback power control section 9 outputs the playback power signal SSr which specifies the output at the time of playback of the semiconductor laser component 4 to the LD mechanical component 20 so that the magnitude of the monitor light-receiving signal Pm may be in agreement with the

magnitude of a control signal RPa.
[0044] The record power control section 10 outputs the record power signal SSw which specifies the output at the time of record of the semiconductor laser component 4 to the LD mechanical component 20 so that the magnitude of the monitor light-receiving signal Pm may be in agreement with the magnitude of a control signal WPa.
[0045] In the condition that the record data DEd are a mark state (logic H level), the LD mechanical component 20 drives the semiconductor laser component 4 with the output specified by the playback power signal SSr by the condition that the record data DEd are a non-mark state (logic L level) while driving the semiconductor laser component 4 with the output specified by the record power signal SSw. That is, the LD mechanical component 20 switches the output of the semiconductor laser component 4 to a high speed at the record power corresponding to the record power signal SSw, and the playback power corresponding to the playback power signal SSr based on the record data DEd.
[0046] Thereby, according to the record data DE, the output of the semiconductor laser component 4 changes to record power and playback power, consequently data are recorded on the recording track of a write once optical disk 2.
[0047] Moreover, it computes asymmetry by the asymmetry judging circuit 13 detecting the amplitude value by the side of plus, and the amplitude value by the side of minus from the zero level of the regenerative signal RF added, and calculating the formula (I) mentioned above based on those amplitude value, and the calculation result is added to the control section 17 as an asymmetry signal ST.
[0048] Moreover, a control section 17 exchanges data various between the external devices (for example, personal computer equipment etc.) using this write once optical disk equipment as external storage while it exchanges other elements of this write once optical disk equipment, and various data and supervises and controls actuation of those elements.
[0049] With the above configuration, when carrying out data logging of the control section 17, it performs actuation shown in drawing 2 and drawing 3 .
[0050] First, seeking to the predetermined test field beforehand set as the write once optical disk 2, changing a control signal WP to a multistage story, and carrying out sequential change of the record power of the semiconductor laser component 4, it is made to generate from the record data generating means (illustration abbreviation) of common knowledge of the record data DE of a predetermined test data, and data write-in actuation of the predetermined amount of data is performed about each record power (processing 101).
[0051] Subsequently, the asymmetry signal ST which carried out sequential playback and inputted the test data recorded by each record power from the asymmetry judging circuit 13 at the time of the playback is saved, and the asymmetry signal ST for every record power is acquired (processing 102).
[0052] And the value of the asymmetry signal ST judges the record power which takes the minimum value, sets the value of the record power as the optimal record power P0 (processing 103), and where the value corresponding to the optimal record power P0 is set to a control signal WP, it starts actual data-logging actuation (processing 104).
[0053] Where Mode SPa is specified, actuation of the sample hold signal generator 15 is started at the same time it starts the data-logging actuation (processing 105). Here, as shown in drawing 4 (a) and (b), after the record data DE start to a mark state, when Mode SPa goes through predetermined time t1, it is a mode of operation which outputs the sample hold signal SP. Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0054] If the sample hold value SHd changed by the analog-to-digital converter 18 is read (processing 106) and the read number turns into a predetermined number, a control section 17 computes the average value of the sample hold value SHd of the read predetermined number, and saves the result as pit level **** at the time of the optimal record power (processing 107).
[0055] Next, a timing change of the actuation of the sample hold signal generator 15 is made at Mode SPb (processing 108). Here, as shown in drawing 4 (c), after the record data DE fall to a non-mark state, when Mode SPb goes through predetermined time t1, it is a mode of operation which outputs the sample

hold signal SP. Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period brought down by playback power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0056] If the sample hold value SHd changed by the analog-to-digital converter 18 is read (processing 109) and the read number turns into a predetermined number, a control section 17 computes the average value of the sample hold value SHd of the read predetermined number, and saves the result as land level Vb at the time of the optimal record power (processing 110).
[0057] Thus, if the pit level **** and the land level Vb at the time of the optimal record power (P0) are obtained, based on the following formula (II), the record condition desired value M0 is computed, and the computed record condition desired value M0 is saved (processing 111).
[0058]
M0=****/(P0xVb) (II) [0059] Next, a control section 17 sets up the value of a control signal WP so that record power may be made into a value only with the small predetermined minute value alpha (processing 112). And a timing change of the actuation of the sample hold signal generator 15 is made at Mode SPa (processing 113). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0060] If the sample hold value SHd changed by the analog-to-digital converter 18 is read (processing 114) and the read number turns into a predetermined number, a control section 17 computes the average value of the sample hold value SHd of the read predetermined number, and saves the result as pit level **** at the time of real record power (processing 115).
[0061] Next, a control section 17 makes a timing change of the actuation of the sample hold signal generator 15 at Mode SPb (processing 116). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period brought down by playback power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0062] If the sample hold value SHd changed by the analog-to-digital converter 18 is read (processing 117) and the read number turns into a predetermined number, a control section 17 computes the average value of the sample hold value SHd of the read predetermined number, and saves the result as land level Vb at the time of real record power (processing 118).
[0063] Thus, if the pit level **** and the land level Vb at the time of real record power (P1) are obtained, a reference value M1 will be computed based on the following formula (III) (processing 119).
[0064]
M1=****/(P1xVb) (II) [0065] And it investigates whether the reference value M1 is larger than the record condition desired value M0 (decision 120). When the value of a control signal WP is set up so that record power may be made into a value only with the large minute value alpha, when the result of decision 120 is set to YES (processing 121), and the result of decision 120 is set to NO, the value of a control signal WP is set up so that record power may be made into a value only with the small predetermined minute value alpha (processing 122). Thus, if it adjusts so that record power may be in the optimal record condition, return and record power of the following cycle will be controlled by processing 121,122 to processing 113. And actuation to processing 113 - processing 122 is repeatedly performed during data-logging actuation.
[0066] Thus, since it tries, writes and carries out in a test field before data logging, the optimal record power P0 is obtained and the inside of data logging is controlling the real record power P1 by this example to be in the same record condition as the optimal record power P0, even when the dependability of the recorded data improves and prolonged continuation record actuation is performed, the stable record quality is acquired.
[0067] Drawing 5 (a) and (b) show other examples of the processing at the time of data logging. In addition, the control section 17 of the equipment shown in drawing 1 performs this processing.
[0068] First, seeking to the predetermined test field beforehand set as the write once optical disk 2, changing a control signal WP to a multistage story, and carrying out sequential change of the record power of the semiconductor laser component 4, it is made to generate from the record data generating

means (illustration abbreviation) of common knowledge of the record data DE of a predetermined test data, and data write-in actuation of the predetermined amount of data is performed about each record power (processing 201).

[0069] Subsequently, the asymmetry signal ST which carried out sequential playback and inputted the test data recorded by each record power from the asymmetry judging circuit 13 at the time of the playback is saved, and the asymmetry signal ST for every record power is acquired (processing 202).

[0070] And the value of the asymmetry signal ST judges the record power which takes the minimum value, sets the value of the record power as the optimal record power P0 (processing 203), and where the value corresponding to the optimal record power P0 is set to a control signal WP, it starts actual data-logging actuation (processing 204).

[0071] Where Mode SPa is specified, actuation of the sample hold signal generator 15 is started at the same time it starts the data-logging actuation (processing 205). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.

[0072] A control section 17 reads the sample hold value SHd changed by the analog-to-digital converter 18 until it starts 1 rotation timer TM 1 with which the time amount equivalent to one rotation of a write once optical disk 2 is set (processing 206) and this timer TM 1 carries out a time-out (processing 207, NO loop formation of decision 208). If the result of decision 208 is set to YES, the average value of the value of the sample hold value SHd then read is computed, and the result is saved as pit level **** at the time of the optimal record power (processing 209).

2 [0073] Thus, if the pit level **** at the time of the optimal record power (P0) is obtained, based on the following formula (IV), the record condition desired value M0 is computed, and the computed record condition desired value M0 is saved (processing 210).

[0074]

M0=****/P0 (IV) [0075] Next, a control section 17 sets up the value of a control signal WP so that record power may be made into a value only with the small predetermined minute value alpha (processing 211), and it is in the condition, and actuation of the sample hold signal generator 15 is started where Mode SPa is specified (processing 212). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.

[0076] A control section 17 reads the sample hold value SHd changed by the analog-to-digital converter 18 until it starts 1 rotation timer TM 1 with which the time amount equivalent to one rotation of a write once optical disk 2 is set (processing 213) and this timer TM 1 carries out a time-out (processing 214, NO loop formation of decision 215). If the result of decision 215 is set to YES, the average value of the value of the sample hold value SHd then read is computed, and the result is saved as pit level **** at the time of real record power (processing 216).

2 [0077] Thus, if the pit level **** at the time of real record power (P1) is obtained, based on the following formula (V), a reference value M1 is computed and the computed reference value M1 is saved (processing 217).

[0078]

M1=****/P1 (V) [0079] And it investigates whether the reference value M1 is larger than the record condition desired value M0 (decision 218). When the value of a control signal WP is set up so that record power may be made into a value only with the large minute value alpha, when the result of decision 218 is set to YES (processing 218), and the result of decision 218 is set to NO, the value of a control signal WP is set up so that record power may be made into a value only with the small predetermined minute value alpha (processing 220). Thus, if it adjusts so that record power may be in the optimal record condition, return and record power of the following cycle will be controlled by processing 219,220 to processing 212. And actuation to processing 212 - processing 220 is repeatedly performed during data-logging actuation.

[0080] Thus, since it tries, writes and carries out in a test field before data logging, the optimal record power P0 is obtained and the inside of data logging is controlling the real record power P1 by this

example to be in the same record condition as the optimal record power P0, even when the dependability of the recorded data improves and prolonged continuation record actuation is performed, the stable record quality is acquired.

[0081] Moreover, since it is carrying out based on the data equivalent to one rotation of a write once optical disk 2 which carried out the period sampling in order to compute the record condition desired value M0, the effect of dispersion in sampling data can be controlled, and more reliable record power control can be performed.

[0082] Drawing 6 shows the important section of the write once optical disk equipment concerning other examples of this invention. In addition, in this drawing, the same sign is given to the same part as drawing 1 , and the corresponding part.

[0083] In this drawing, optical pickup equipment 1 is for reproducing data from a write once optical disk 2, while recording data on a write once optical disk 2, and the photo detector 6 for signal detection for detecting the photo detector 5 for output monitors for detecting the output level of the semiconductor laser component 4 used as the light source and the semiconductor laser component 4 and the reflected light from a write once optical disk 2 is formed in the optical head 3. In addition, the tracking control means (illustration abbreviation) for making the laser beam of the focusing control means (illustration abbreviation) for uniting a focus with a recording track for the laser beam of the optical head 3 or an optical head follow a recording track etc. is attached to optical pickup equipment 1. Moreover, the seeking device (illustration abbreviation) which carries out both-way migration of the optical head 3 radial [of a write once optical disk 2] is also prepared in optical pickup equipment 1.

[0084] After the monitor light-receiving signal Pm outputted from the photo detector 5 for output monitors is changed into a voltage signal through a current / electrical-potential-difference conversion amplifier 8, it is added to the playback power control section 9 and the record power control section 10.

[0085] It is outputted to next step equipment as a regenerative signal RF while it is added to a sample / hold circuit 12, the asymmetry judging circuit 13, and the defective detector 25, after the signal light-receiving signal Pa outputted from the photo detector 6 for signal detection is changed into a voltage signal through a current / electrical-potential-difference conversion amplifier 11.

[0086] The record data DE which are added from a well-known record data generating means (illustration abbreviation) and by which the EFM (Eight to Fourteen Modulation) modulation was carried out are added to the sample hold signal generator 15 and the delay circuit 16.

[0087] The sample hold signal generator 15 is a mode according to mode signal MS added from a control section 17, the sampling signal SP is outputted to the timing which has gone through the predetermined sampling time from the standup timing of the record data DE, and the sampling signal SP is added to the sample / hold circuit 12.

[0088] Thereby, a sample / hold circuit 12 samples the signal added to the timing (for example, rising edge of the sampling signal SP) to which the sampling signal SP is added, and outputs it to an analog-to-digital converter 18 by making the sampling result into the sample hold value SH.

[0089] An analog-to-digital converter 18 changes the sample hold value SH applied into a corresponding digital signal, and the output signal is applied to the control section 17 as a sample hold value SHd.

[0090] A delay circuit 16 delays the record data DE added predetermined delay time, and the output signal is applied to the control section 17 and LD (semiconductor laser component) drive circuit 20 as record data DEd.

[0091] A control section 17 controls actuation of this write once optical disk equipment, forms the control signal RP for specifying the output at the time of playback of the semiconductor laser component 4, and the control signal WP which specifies the output at the time of record of the semiconductor laser component 4, and outputs these control signals RP and a control signal WP to a digital to analog converter 21 and a digital to analog converter 22, respectively.

[0092] A digital to analog converter 21 changes the control signal RP added into a corresponding analog signal, and the output signal is applied to the playback power control section 9 as a control signal RPa.

[0093] A digital to analog converter 22 changes the control signal WP added into a corresponding

analog signal, and the output signal is applied to the record power control section 10 as a control signal WPa.

[0094] The playback power control section 9 outputs the playback power signal SSr which specifies the output at the time of playback of the semiconductor laser component 4 to the LD mechanical component 20 so that the magnitude of the monitor light-receiving signal Pm may be in agreement with the magnitude of a control signal RPa.

[0095] The record power control section 10 outputs the record power signal SSw which specifies the output at the time of record of the semiconductor laser component 4 to the LD mechanical component 20 so that the magnitude of the monitor light-receiving signal Pm may be in agreement with the magnitude of a control signal WPa.

[0096] In the condition that the record data DEd are a mark state (logic H level), the LD mechanical component 20 drives the semiconductor laser component 4 with the output specified by the playback power signal SSr by the condition that the record data DEd are a non-mark state (logic L level) while driving the semiconductor laser component 4 with the output specified by the record power signal SSw. That is, the LD mechanical component 20 switches the output of the semiconductor laser component 4 to a high speed at the record power corresponding to the record power signal SSw, and the playback power corresponding to the playback power signal SSr based on the record data DEd.

[0097] Thereby, according to the record data DE, the output of the semiconductor laser component 4 changes to record power and playback power, consequently data are recorded on the recording track of a write once optical disk 2.

[0098] Moreover, it computes asymmetry by the asymmetry judging circuit 13 detecting the amplitude value by the side of plus, and the amplitude value by the side of minus from the zero level of the regenerative signal RF added, and calculating the formula (I) mentioned above based on those amplitude value, and the calculation result is added to the control section 17 as an asymmetry signal ST.

[0099] Moreover, a control section 17 exchanges data various between the external devices (for example, personal computer equipment etc.) using this write once optical disk equipment as external storage while it exchanges other elements of this write once optical disk equipment, and various data and supervises and controls actuation of those elements.

[0100] Moreover, when the defective detector 25 detects the medium defect produced in the write once optical disk 2 and the condition below a predetermined value continues [for example, / the level of a regenerative signal RF] beyond predetermined time (for example, about several microseconds), it judges with having detected the medium defect. And detection of a medium defect outputs the defective detecting signal DD to a control section 17.

[0101] Drawing 7 and drawing 8 show the example of processing which the control section 17 of the equipment of drawing 6 performs at the time of data logging.

[0102] First, seeking to the predetermined test field beforehand set as the write once optical disk 2, changing a control signal WP to a multistage story, and carrying out sequential change of the record power of the semiconductor laser component 4, it is made to generate from the record data generating means of common knowledge of the record data DE of a predetermined test data, and data write-in actuation of the predetermined amount of data is performed about each record power (processing 301).

[0103] Subsequently, the asymmetry signal ST which carried out sequential playback and inputted the test data recorded by each record power from the asymmetry judging circuit 13 at the time of the playback is saved, and the asymmetry signal ST for every record power is acquired (processing 302).

[0104] And the value of the asymmetry signal ST judges the record power which takes the minimum value, sets the value of the record power as the optimal record power P0 (processing 303), and where the value corresponding to the optimal record power P0 is set to a control signal WP, it starts actual data-logging actuation (processing 304).

[0105] Where Mode SPa is specified, actuation of the sample hold signal generator 15 is started at the same time it starts the data-logging actuation (processing 305). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.

[0106] A control section 17 reads the sample hold value SHd changed by the analog-to-digital converter 18 (processing 306), and investigates whether the defective detecting signal DD is then outputted (decision 307). When the result of decision 307 is set to YES, since it obtains from the field which the medium defect has produced, the sample hold value SHd inputted immediately before cancels the sample hold value SHd inputted just before that (processing 308), and reads return and the following sample hold value SHd into processing 306.
[0107] Moreover, since suitable data are obtained when the result of decision 307 is set to NO, when it investigates whether the sampling of the data of a predetermined number was completed (decision 309) and the result of decision 309 is set to NO, return and the following sample hold value SHd are read into processing 306.
[0108] When the result of decision 309 is set to YES, the average value of the value of the sample hold value SHd of the predetermined number then read and obtained is computed, the result is made into the pit level **** at the time of the optimal record power, based on the formula (IV) mentioned above, the record condition desired value M0 is computed, and the computed record condition desired value M0 is saved (processing 310).
[0109] Next, a control section 17 sets up the value of a control signal WP so that record power may be made into a value only with the small predetermined minute value alpha (processing 311), and it is in the condition, and actuation of the sample hold signal generator 15 is started where Mode SPa is specified (processing 312). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0110] A control section 17 reads the sample hold value SHd changed by the analog-to-digital converter 18 (processing 313), and investigates whether the defective detecting signal DD is then outputted (decision 314). When the result of decision 314 is set to YES, since it obtains from the field which the medium defect has produced, the sample hold value SHd inputted immediately before cancels the sample hold value SHd inputted just before that (processing 315), and reads return and the following sample hold value SHd into processing 313.
[0111] Moreover, since suitable data are obtained when the result of decision 314 is set to NO, when it investigates whether the sampling of the data of a predetermined number was completed (decision 316) and the result of decision 316 is set to NO, return and the following sample hold value SHd are read into processing 312.
[0112] When the result of decision 316 is set to YES, the average value of the value of the sample hold value SHd of the predetermined number then read and obtained is computed, the result is made into the pit level **** at the time of real record power (P1) (processing 317), based on the formula (V) mentioned above, a reference value M1 is computed and the computed reference value M1 is saved (processing 318).
[0113] And it investigates whether the reference value M1 is larger than the record condition desired value M0 (decision 319). When the value of a control signal WP is set up so that record power may be made into a value only with the large minute value alpha, when the result of decision 319 is set to YES (processing 320), and the result of decision 319 is set to NO, the value of a control signal WP is set up so that record power may be made into a value only with the small predetermined minute value alpha (processing 321). Thus, if it adjusts so that record power may be in the optimal record condition, return and record power of the following cycle will be controlled by processing 320,321 to processing 312. And actuation to processing 312 - processing 321 is repeatedly performed during data-logging actuation.

[0114] Thus, since it tries, writes and carries out in a test field before data logging, the optimal record power P0 is obtained and the inside of data logging is controlling the real record power P1 by this example to be in the same record condition as the optimal record power P0, even when the dependability of the recorded data improves and prolonged continuation record actuation is performed, the stable record quality is acquired.
[0115] Moreover, since the data used in order to compute the record condition desired value M0 remove

the data obtained from the defective field of a write once optical disk 2, they can control the effect of a medium defect, consequently can perform more reliable record power control.
[0116] Now, the reflected light reinforcement from a write once optical disk 2 changes, as shown in drawing 9 . It is a wave when the semiconductor laser component 4 drives from 0T pit location by record power up to 11T pit location here, and other parts are waves when the semiconductor laser component 4 drives by playback power. Moreover, reflected light reinforcement serves as peak value just behind 0T pit location because the recording surface of a write once optical disk 2 is a mirror plane, by irradiating the laser beam of record power continuously, a pit is formed and, thereby, reflected light reinforcement falls.
[0117] In this case, the timing which samples the signal of the pit level **** will be shown in drawing by reflected light reinforcement when the difference in the property by the difference in the media of a write once optical disk 2 becomes a cause and carries out data logging in the state of optimal record with a broken line, although 4T pit location has been criteria. In this case, a sampling value with better sampling the pit level **** to the timing before 4T pit location may be able to be acquired. In addition, the sampling timing of the land level Vb is timing as shown in drawing.
[0118] Then, if change gradually the sampling timing of the sample signal SP given to a sample / hold circuit 12, the pit level **** is detected, the changing point (refer to drawing 11) of level change of the pit level **** is searched for and the sampling timing immediately after the changing point is set as the sampling timing of the write once optical disk 2 as shown in drawing 10 (a) - (d), the better pit level **** is detectable.
[0119] Drawing 12 and drawing 13 show an example of the data-logging processing in this case. In addition, this processing is processing which the control section 17 of the equipment shown in drawing 6 performs.
[0120] First, seeking to the predetermined test field beforehand set as the write once optical disk 2, changing a control signal WP to a multistage story, and carrying out sequential change of the record power of the semiconductor laser component 4, it is made to generate from the record data generating means of common knowledge of the record data DE of a predetermined test data, and data write-in actuation of the predetermined amount of data is performed about each record power (processing 401).
[0121] Subsequently, the asymmetry signal ST which carried out sequential playback and inputted the test data recorded by each record power from the asymmetry judging circuit 13 at the time of the playback is saved, and the asymmetry signal ST for every record power is acquired (processing 402).
[0122] And the value of the asymmetry signal ST judges the record power which takes the minimum value, sets the value of the record power as the optimal record power P0 (processing 403), and where the value corresponding to the optimal record power P0 is set to a control signal WP, it starts actual data-logging actuation (processing 404).
[0123] It is set as the condition of expressing the sampling timing which is not performing the mode of operation of the sample hold signal generator 15 then (processing 405), and the sampling action of the set-up sampling timing is started at the same time it starts the data-logging actuation (processing 406). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power to the sampling timing then set up, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0124] A control section 17 computes the average of predetermined number reading (processing 407) and its read sample hold value SHd, and saves the sample hold value SHd changed by the analog-to-digital converter 18 as pit level **** corresponding to the sampling timing for the computed average (processing 408).
[0125] And when it investigates whether the pit level **** about all sampling timing was obtained (decision 409) and the result of decision 409 is set to NO, the pit level **** is formed in processing 405 about return and the following sampling timing.
[0126] Moreover, when the result of decision 409 is set to YES, the pit level **** then saved is investigated in order of sampling timing, the changing point of the pit level **** is judged, it determines as sampling timing which uses the sampling timing of the judged changing point then, and the mode of

operation of the sampling timing is set as the sample hold signal generator 15 (processing 410). Thereby, to the sampling timing near [which was then judged] a changing point, a sample / hold circuit 12 samples the signal light-receiving signal Pa, and outputs it as a sample hold value SH.

[0127] Thus, if sampling timing is determined, a control section 17 will read the sample hold value SHd changed by the analog-to-digital converter 18 (processing 411), and will investigate whether the defective detecting signal DD is then outputted (decision 412). When the result of decision 412 is set to YES, since it obtains from the field which the medium defect has produced, the sample hold value SHd inputted immediately before cancels the sample hold value SHd inputted just before that (processing 413), and reads return and the following sample hold value SHd into processing 411.

[0128] Moreover, since suitable data are obtained when the result of decision 412 is set to NO, when it investigates whether the sampling of the data of a predetermined number was completed (decision 414) and the result of decision 414 is set to NO, return and the following sample hold value SHd are read into processing 411.

[0129] When the result of decision 414 is set to YES, the average value of the value of the sample hold value SHd of the predetermined number then read and obtained is computed, the result is made into the pit level **** at the time of the optimal record power, based on the formula (IV) mentioned above, the record condition desired value M0 is computed, and the computed record condition desired value M0 is saved (processing 415).

[0130] Next, a control section 17 sets up the value of a control signal WP so that record power may be made into a value only with the small predetermined minute value alpha (processing 416), is in the condition and starts actuation of the sample hold signal generator 15 (processing 417). Thereby, to the sampling timing near [which was then judged] a changing point, a sample / hold circuit 12 samples the signal light-receiving signal Pa, and outputs it as a sample hold value SH.

[0131] A control section 17 reads the sample hold value SHd changed by the analog-to-digital converter 18 (processing 418), and investigates whether the defective detecting signal DD is then outputted (decision 419). When the result of decision 419 is set to YES, since it obtains from the field which the medium defect has produced, the sample hold value SHd inputted immediately before cancels the sample hold value SHd inputted just before that (processing 420), and reads return and the following sample hold value SHd into processing 418.

[0132] Moreover, since suitable data are obtained when the result of decision 419 is set to NO, when it investigates whether the sampling of the data of a predetermined number was completed (decision 421) and the result of decision 421 is set to NO, return and the following sample hold value SHd are read into processing 418.

[0133] When the result of decision 421 is set to YES, the average value of the value of the sample hold value SHd of the predetermined number then read and obtained is computed, the result is made into the pit level **** at the time of real record power (P1) (processing 422), based on the formula (V) mentioned above, a reference value M1 is computed and the computed reference value M1 is saved (processing 423).

[0134] And it investigates whether the reference value M1 is larger than the record condition desired value M0 (decision 424). When the value of a control signal WP is set up so that record power may be made into a value only with the large minute value alpha, when the result of decision 424 is set to YES (processing 425), and the result of decision 424 is set to NO, the value of a control signal WP is set up so that record power may be made into a value only with the small predetermined minute value alpha (processing 426). Thus, if it adjusts so that record power may be in the optimal record condition, return and record power of the following cycle will be controlled by processing 425,426 to processing 417. And actuation to processing 417 - processing 426 is repeatedly performed during data-logging actuation.

[0135] Thus, since it tries, writes and carries out in a test field before data logging, the optimal record power P0 is obtained and the inside of data logging is controlling the real record power P1 by this example to be in the same record condition as the optimal record power P0, even when the dependability of the recorded data improves and prolonged continuation record actuation is performed, the stable

record quality is acquired.
[0136] Moreover, since the data used in order to compute the record condition desired value M0 remove the data obtained from the defective field of a write once optical disk 2, they can control the effect of a medium defect, consequently can perform more reliable record power control.
[0137] Moreover, since the sampling timing of the data used in order to compute the record condition desired value M0 is determined according to the write once optical disk 2 then used, more suitable data can be obtained and the dependability of data logging improves.
[0138] Drawing 14 shows the important section of the write once optical disk equipment concerning the example of further others of this invention. In addition, in this drawing, the same sign is given to the same part as drawing 1 , and the corresponding part.
[0139] In this drawing, optical pickup equipment 1 is for reproducing data from a write once optical disk 2, while recording data on a write once optical disk 2, and the photo detector 6 for signal detection for detecting the photo detector 5 for output monitors for detecting the output level of the semiconductor laser component 4 used as the light source and the semiconductor laser component 4 and the reflected light from a write once optical disk 2 is formed in the optical head 3. In addition, the tracking control means (illustration abbreviation) for making the laser beam of the focusing control means (illustration abbreviation) for uniting a focus with a recording track for the laser beam of the optical head 3 or an optical head follow a recording track etc. is attached to optical pickup equipment 1. Moreover, the seeking device (illustration abbreviation) which carries out both-way migration of the optical head 3 radial [of a write once optical disk 2] is also prepared in optical pickup equipment 1.
[0140] After the monitor light-receiving signal Pm outputted from the photo detector 5 for output monitors is changed into a voltage signal through a current / electrical-potential-difference conversion amplifier 8, it is added to the playback power control section 9 and the record power control section 10.
[0141] It is outputted to next step equipment as a regenerative signal RF while it is added to the adjustable gain amplifier 28 and the asymmetry judging circuit 13, after the signal light-receiving signal Pa outputted from the photo detector 6 for signal detection is changed into a voltage signal through a current / electrical-potential-difference conversion amplifier 11. The gain is controlled by the gain control signal GS by which the adjustable gain amplifier 28 is added from a control section 17, and the output signal is applied to the sample / hold circuit 12 as a regenerative signal RFa.
[0142] The record data DE which are added from a well-known record data generating means (illustration abbreviation) and by which the EFM (Eight to Fourteen Modulation) modulation was carried out are added to the sample hold signal generator 15 and the delay circuit 16.
[0143] The sample hold signal generator 15 is a mode according to mode signal MS added from a control section 17, the sampling signal SP is outputted to the timing which has gone through the predetermined sampling time from the standup timing of the record data DE, and the sampling signal SP is added to the sample / hold circuit 12.
[0144] Thereby, a sample / hold circuit 12 samples the regenerative signal RFa added to the timing (for example, rising edge of the sampling signal SP) to which the sampling signal SP is added, and outputs it to an analog-to-digital converter 18 by making the sampling result into the sample hold value SH.
[0145] An analog-to-digital converter 18 changes the sample hold value SH applied into a corresponding digital signal, and the output signal is applied to the control section 17 as a sample hold value SHd.
[0146] A delay circuit 16 delays the record data DE added predetermined delay time, and the output signal is applied to the control section 17 and LD (semiconductor laser component) drive circuit 20 as record data DEd.
[0147] A control section 17 controls actuation of this write once optical disk equipment, forms the control signal RP for specifying the output at the time of playback of the semiconductor laser component 4, and the control signal WP which specifies the output at the time of record of the semiconductor laser component 4, and outputs these control signals RP and a control signal WP to a digital to analog converter 21 and a digital to analog converter 22, respectively.
[0148] A digital to analog converter 21 changes the control signal RP added into a corresponding analog

signal, and the output signal is applied to the playback power control section 9 as a control signal RPa.
[0149] A digital to analog converter 22 changes the control signal WP added into a corresponding analog signal, and the output signal is applied to the record power control section 10 as a control signal WPa.
[0150] The playback power control section 9 outputs the playback power signal SSr which specifies the output at the time of playback of the semiconductor laser component 4 to the LD mechanical component 20 so that the magnitude of the monitor light-receiving signal Pm may be in agreement with the magnitude of a control signal RPa.
[0151] The record power control section 10 outputs the record power signal SSw which specifies the output at the time of record of the semiconductor laser component 4 to the LD mechanical component 20 so that the magnitude of the monitor light-receiving signal Pm may be in agreement with the magnitude of a control signal WPa.
[0152] In the condition that the record data DEd are a mark state (logic H level), the LD mechanical component 20 drives the semiconductor laser component 4 with the output specified by the playback power signal SSr by the condition that the record data DEd are a non-mark state (logic L level) while driving the semiconductor laser component 4 with the output specified by the record power signal SSw. That is, the LD mechanical component 20 switches the output of the semiconductor laser component 4 to a high speed at the record power corresponding to the record power signal SSw, and the playback power corresponding to the playback power signal SSr based on the record data DEd.
[0153] Thereby, according to the record data DE, the output of the semiconductor laser component 4 changes to record power and playback power, consequently data are recorded on the recording track of a write once optical disk 2.
[0154] Moreover, it computes asymmetry by the asymmetry judging circuit 13 detecting the amplitude value by the side of plus, and the amplitude value by the side of minus from the zero level of the regenerative signal RF added, and calculating the formula (I) mentioned above based on those amplitude value, and the calculation result is added to the control section 17 as an asymmetry signal ST.
[0155] Moreover, a control section 17 exchanges data various between the external devices (for example, personal computer equipment etc.) using this write once optical disk equipment as external storage while it exchanges other elements of this write once optical disk equipment, and various data and supervises and controls actuation of those elements.
[0156] With the above configuration, when carrying out data logging of the control section 17, it performs actuation shown in drawing 15 and drawing 16 .
[0157] First, seeking to the predetermined test field beforehand set as the write once optical disk 2, changing a control signal WP to a multistage story, and carrying out sequential change of the record power of the semiconductor laser component 4, it is made to generate from the record data generating means (illustration abbreviation) of common knowledge of the record data DE of a predetermined test data, and data write-in actuation of the predetermined amount of data is performed about each record power (processing 501).
[0158] Subsequently, the asymmetry signal ST which carried out sequential playback and inputted the test data recorded by each record power from the asymmetry judging circuit 13 at the time of the playback is saved, and the asymmetry signal ST for every record power is acquired (processing 502).
[0159] And the value of the asymmetry signal ST judges the record power which takes the minimum value, sets the value of the record power as the optimal record power P0 (processing 503), and where the value corresponding to the optimal record power P0 is set to a control signal WP, it starts actual data-logging actuation (processing 504).
[0160] Where the mode SPa which mentioned above actuation of the sample hold signal generator 15 is specified, it starts, at the same time it starts the data-logging actuation (processing 505). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0161] A control section 17 adjusts the gain of the adjustable gain amplifier 28 so that the sample hold value SHd at that time may turn into a value of the predetermined range (processing 506). And if the

sample hold value SHd changed by the analog-to-digital converter 18 is read (processing 507) and the read number turns into a predetermined number, the average value of the sample hold value SHd of the read predetermined number is computed, and the result is saved as pit level **** at the time of the optimal record power (processing 508).

[0162] Next, a timing change of the actuation of the sample hold signal generator 15 is made at the mode SPb mentioned above (processing 508). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period brought down by playback power, and outputs a sample / hold circuit 12 as a sample hold value SH.

[0163] A control section 17 adjusts the gain of the adjustable gain amplifier 28 so that the sample hold value SHd at that time may turn into a value of the predetermined range (processing 510). And if the sample hold value SHd changed by the analog-to-digital converter 18 is read (processing 511) and the read number turns into a predetermined number, the average value of the sample hold value SHd of the read predetermined number is computed, and the result is saved as land level Vb at the time of the optimal record power (processing 512).

[0164] Thus, if the pit level **** and the land level Vb at the time of the optimal record power (P0) are obtained, based on the formula (II) mentioned above, the record condition desired value M0 is computed, and the computed record condition desired value M0 is saved (processing 513).

[0165] Next, a control section 17 sets up the value of a control signal WP so that record power may be made into a value only with the small predetermined minute value alpha (processing 514). And a timing change of the actuation of the sample hold signal generator 15 is made at Mode SPa (processing 515). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.

[0166] Moreover, a control section 17 sets the gain required in processing 506 as the adjustable gain amplifier 28 next (processing 516). And if the sample hold value SHd changed by the analog-to-digital converter 18 is read (processing 517) and the read number turns into a predetermined number, the average value of the sample hold value SHd of the read predetermined number is computed, and the result is saved as pit level **** at the time of real record power (processing 518).

[0167] Next, a control section 17 makes a timing change of the actuation of the sample hold signal generator 15 at Mode SPb (processing 519). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period brought down by playback power, and outputs a sample / hold circuit 12 as a sample hold value SH.

[0168] Moreover, a control section 17 sets the gain required in processing 510 as the adjustable gain amplifier 28 next (processing 520). And if the sample hold value SHd changed by the analog-to-digital converter 18 is read (processing 521) and the read number turns into a predetermined number, the average value of the sample hold value SHd of the read predetermined number is computed, and the result is saved as land level Vb at the time of real record power (processing 522).

[0169] Thus, if the pit level **** and the land level Vb at the time of real record power (P1) are obtained, a reference value M1 will be computed based on the formula (III) mentioned above (processing 523).

[0170] And it investigates whether the reference value M1 is larger than the record condition desired value M0 (decision 524). When the value of a control signal WP is set up so that record power may be made into a value only with the large minute value alpha, when the result of decision 524 is set to YES (processing 525), and the result of decision 524 is set to NO, the value of a control signal WP is set up so that record power may be made into a value only with the small predetermined minute value alpha (processing 526). Thus, if it adjusts so that record power may be in the optimal record condition, return and record power of the following cycle will be controlled by processing 525,526 to processing 515. And actuation to processing 515 - processing 526 is repeatedly performed during data-logging actuation.

[0171] Thus, since it tries, writes and carries out in a test field before data logging, the optimal record power P0 is obtained and the inside of data logging is controlling the real record power P1 by this example to be in the same record condition as the optimal record power P0, even when the dependability

of the recorded data improves and prolonged continuation record actuation is performed, the stable record quality is acquired.
[0172] Moreover, since the gain of the adjustable gain amplifier 28 is adjusted and level is adjusted to the suitable value when sampling data, suitable data can be obtained and the dependability of data logging improves.
[0173] By the way, the value of the record condition desired value M0 mentioned above may change in non-monotone, as it is indicated in drawing 18 as the case where it changes in monotone according to the magnitude of the optimal record power P0 as shown in drawing 17 . Such reduction is considered that the property of a write once optical disk 2 results.
[0174] Thus, when using the write once optical disk 2 in which the record condition desired value M0 carries out monotone change according to the magnitude of the optimal record power P0, like the example explained until now, a reference value M1 is calculated at the time of real record, and the record power control based on the comparison result of the reference value M1 and the storage condition desired value M0 is effective.
[0175] When using the write once optical disk 2 in which the record condition desired value M0 does not carry out monotone change according to the magnitude of the optimal record power P0 to it, and a reference value M1 is calculated at the time of real record and record power control based on the comparison result of the reference value M1 and the storage condition desired value M0 is performed like the example explained until now, there is a possibility that record power may not be controlled by the suitable value.
[0176] An example of the record processing in this case is shown in drawing 19 , drawing 20 , and drawing 21 . In addition, this record processing is processing which the control section 17 of the equipment shown in drawing 1 performs.
[0177] First, actuation of the sample hold signal generator 15 is started where Mode SPa is specified (processing 601). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0178] Next, a control section 17 chooses the record power which is not recording the test data, and sets the value of a control signal WP as the value corresponding to the record power (processing 602). It is made to generate from the record data generating means (illustration abbreviation) of common knowledge of the record data DE of a predetermined test data. If the test data is recorded on a predetermined test field (processing 603), the sample hold value SHd changed by the analog-to-digital converter 18 at that time is read (processing 604) and the read number turns into a predetermined number The average value of the sample hold value SHd of the read predetermined number is computed, and the result is saved as pit level **** in the record power (processing 605).
[0179] And when it investigates whether the processing about all record power was completed (decision 606) and the result of decision 606 is set to NO, actuation same about return and the following record power is carried out to processing 602.
[0180] When the result of decision 606 is set to YES, it investigates whether the value of the pit level **** is arranged in order of the magnitude of record power, and the pit level **** is carrying out the increment in monotone (processing 607, decision 608). Here, it is the same semantics that the pit level **** shows monotonicity as the record condition desired value M0 shows monotonicity.
[0181] When the result of decision 608 is set to NO, the asymmetry signal ST which carried out sequential playback and inputted the test data recorded on the test field by each record power from the asymmetry judging circuit 13 at the time of the playback is saved, and the asymmetry signal ST for every record power is acquired (processing 609).
[0182] And the value of the asymmetry signal ST judges the record power which takes the minimum value, sets the value of the record power as the optimal record power P0 (processing 610), and where the value corresponding to the optimal record power P0 is set to a control signal WP, it starts actual data-logging actuation (processing 611). And record power is fixed to the optimal record power P0 during record actuation (processing 612).

[0183] Moreover, when the result of decision 608 is set to YES, the asymmetry signal ST which carried out sequential playback and inputted the test data recorded on the test field by each record power from the asymmetry judging circuit 13 at the time of the playback is saved, and the asymmetry signal ST for every record power is acquired (processing 613).
[0184] And the value of the asymmetry signal ST judges the record power which takes the minimum value, sets the value of the record power as the optimal record power P0 (processing 614), and where the value corresponding to the optimal record power P0 is set to a control signal WP, it starts actual data-logging actuation (processing 615).
[0185] Where the mode SPa which mentioned above actuation of the sample hold signal generator 15 is specified, it starts, at the same time it starts the data-logging actuation (processing 105). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0186] If the sample hold value SHd changed by the analog-to-digital converter 18 is read (processing 617) and the read number turns into a predetermined number, a control section 17 computes the average value of the sample hold value SHd of the read predetermined number, and saves the result as pit level **** at the time of the optimal record power (processing 618).
[0187] Next, a control section 17 makes a timing change of the actuation of the sample hold signal generator 15 at the mode SPb mentioned above (processing 619). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period brought down by playback power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0188] If the sample hold value SHd changed by the analog-to-digital converter 18 is read (processing 620) and the read number turns into a predetermined number, a control section 17 computes the average value of the sample hold value SHd of the read predetermined number, and saves the result as land level Vb at the time of the optimal record power (processing 621).
[0189] Thus, if the pit level **** and the land level Vb at the time of the optimal record power (P0) are obtained, based on the formula (II) mentioned above, the record condition desired value M0 is computed, and the computed record condition desired value M0 is saved (processing 622).
[0190] Next, a control section 17 sets up the value of a control signal WP so that record power may be made into a value only with the small predetermined minute value alpha (processing 623). And a timing change of the actuation of the sample hold signal generator 15 is made at Mode SPa (processing 624). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0191] If the sample hold value SHd changed by the analog-to-digital converter 18 is read (processing 625) and the read number turns into a predetermined number, a control section 17 computes the average value of the sample hold value SHd of the read predetermined number, and saves the result as pit level **** at the time of real record power (processing 626).
[0192] Next, a control section 17 makes a timing change of the actuation of the sample hold signal generator 15 at Mode SPb (processing 627). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period brought down by playback power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0193] If the sample hold value SHd changed by the analog-to-digital converter 18 is read (processing 628) and the read number turns into a predetermined number, a control section 17 computes the average value of the sample hold value SHd of the read predetermined number, and saves the result as land level Vb at the time of real record power (processing 629).
[0194] Thus, if the pit level **** and the land level Vb at the time of real record power (P1) are obtained, a reference value M1 will be computed based on the formula (III) mentioned above (processing 630).
[0195] And it investigates whether the reference value M1 is larger than the record condition desired value M0 (decision 631). When the value of a control signal WP is set up so that record power may be made into a value only with the large minute value alpha, when the result of decision 631 is set to YES (processing 632), and the result of decision 631 is set to NO, the value of a control signal WP is set up

so that record power may be made into a value only with the small predetermined minute value alpha (processing 632). Thus, if it adjusts so that record power may be in the optimal record condition, return and record power of the following cycle will be controlled by processing 631,632 to processing 624. And actuation to processing 624 - processing 633 is repeatedly performed during data-logging actuation.

[0196] Thus, in this example, since the optimal record power P0 is held when the record condition desired value M0 does not carry out monotone change according to record power, suitable record power control can be performed according to the property of a write once optical disk 2.
[0197] Drawing 22 and drawing 23 show the example of further others of data-logging processing. In addition, the control section 17 of the equipment of drawing 1 performs this data-logging processing.
[0198] First, seeking to the predetermined test field beforehand set as the write once optical disk 2, changing a control signal WP to a multistage story, and carrying out sequential change of the record power of the semiconductor laser component 4, it is made to generate from the record data generating means (illustration abbreviation) of common knowledge of the record data DE of a predetermined test data, and data write-in actuation of the predetermined amount of data is performed about each record power (processing 701).
[0199] Subsequently, the asymmetry signal ST which carried out sequential playback and inputted the test data recorded by each record power from the asymmetry judging circuit 13 at the time of the playback is saved, and the asymmetry signal ST for every record power is acquired (processing 702).
[0200] And the value of the asymmetry signal ST judges the record power which takes the minimum value, sets the value of the record power as the optimal record power P0 (processing 703), and where the value corresponding to the optimal record power P0 is set to a control signal WP, it starts actual data-logging actuation (processing 704).
[0201] Where the mode SPa which mentioned above actuation of the sample hold signal generator 15 is specified, it starts, at the same time it starts the data-logging actuation (processing 705). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0202] A control section 17 reads the sample hold value SHd changed by the analog-to-digital converter 18 until it starts 1 rotation timer TM 1 with which the time amount equivalent to one rotation of a write once optical disk 2 is set (processing 706) and this timer TM 1 carries out a time-out (processing 707, NO loop formation of decision 708). If the result of decision 708 is set to YES, the average value of the value of the sample hold value SHd then read is computed, and the result is saved as pit level **** at the time of the optimal record power (processing 709).
[0203] Thus, if the pit level **** at the time of the optimal record power (P0) is obtained, based on the formula (IV) mentioned above, the record condition desired value M0 is computed, and the computed record condition desired value M0 is saved (processing 710).
[0204] Next, a control section 17 sets up the value of a control signal WP so that record power may be made into a value only with the small predetermined minute value alpha (processing 711), and where the mode SPa which is in the condition and mentioned above actuation of the sample hold signal generator 15 is specified, it starts it (processing 712). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0205] A control section 17 reads the sample hold value SHd changed by the analog-to-digital converter 18 until it starts 1 rotation timer TM 1 with which the time amount equivalent to one rotation of a write once optical disk 2 is set (processing 713) and this timer TM 1 carries out a time-out (processing 714, NO loop formation of decision 715). If the result of decision 715 is set to YES, the average value of the value of the sample hold value SHd then read is computed, and the result is saved as pit level **** at the time of real record power (processing 716).
[0206] Thus, if the pit level **** at the time of real record power (P1) is obtained, based on the formula (V) mentioned above, a reference value M1 is computed and the computed reference value M1 is saved (processing 717).

[0207] And it investigates whether the reference value M1 is larger than the record condition desired value M0 (decision 718). When the value of a control signal WP is set up so that record power P1 may be made into a value only with the large minute value alpha, when the result of decision 718 is set to YES (processing 718), and the result of decision 718 is set to NO, the value of a control signal WP is set up so that record power P1 may be made into a value only with the small predetermined minute value alpha (processing 720).
[0208] Thus, if processing 719,720 adjusts so that the record power P1 may be in the optimal record condition, it will investigate whether the value of the record power P1 after adjustment is larger than the value which applied the predetermined value beta (>alpha) to the optimal record power P0 (decision 721). Since the value after adjustment is an excessive value when the result of decision 721 is set to YES, the value of the record power P1 is set as the value which applied the predetermined value beta to the optimal record power P0 (processing 722), and return and record power of the following cycle are controlled to processing 712.
[0209] Moreover, when the result of decision 721 is set to NO, it investigates whether the value of the record power P1 after adjustment is smaller than the value which subtracted the predetermined value beta from the optimal record power P0 (decision 723). Since the value after adjustment is too little value when the result of decision 723 is set to YES, the value of the record power P1 is set as the value which subtracted the predetermined value beta from the optimal record power P0 (processing 724), and return and record power of the following cycle are controlled to processing 712.
[0210] Moreover, since the value of the record power P1 after adjustment is the case where it is contained in the suitable range (P0**beta) when the result of decision 723 is set to NO, return and record power of the following cycle are controlled by the condition as it is to processing 712. And actuation to processing 712 - processing 724 is repeatedly performed during data-logging actuation.
[0211] Thus, in this example, since the magnitude of the record power P1 is restricted to the predetermined range (P0**beta), the defect of a circuit etc. becomes a cause and the situation to which record actuation is carried out by extremely unusual power can be avoided.
[0212] By the way, if data-logging actuation is performed to the write once optical disk 2, since temperature will rise according to the time amount of the record actuation, when the optimal record power P0 is determined, it is desirable [the value beta which specifies the setting range of the record power P1 mentioned above] to set up according to the temperature change to a setup of the real record power P1 from from.
[0213] The example of processing at the time of data logging in this case is shown in drawing 24 and drawing 25 .
[0214] First, seeking to the predetermined test field beforehand set as the write once optical disk 2, changing a control signal WP to a multistage story, and carrying out sequential change of the record power of the semiconductor laser component 4, it is made to generate from the record data generating means (illustration abbreviation) of common knowledge of the record data DE of a predetermined test data, and data write-in actuation of the predetermined amount of data is performed about each record power (processing 801).
[0215] Subsequently, the asymmetry signal ST which carried out sequential playback and inputted the test data recorded by each record power from the asymmetry judging circuit 13 at the time of the playback is saved, and the asymmetry signal ST for every record power is acquired (processing 802).
[0216] And the value of the asymmetry signal ST judges the record power which takes the minimum value, sets the value of the record power as the optimal record power P0 (processing 803), and where the value corresponding to the optimal record power P0 is set to a control signal WP, it starts actual data-logging actuation (processing 804).
[0217] Where the mode SPa which mentioned above actuation of the sample hold signal generator 15 is specified, it starts, at the same time it starts the data-logging actuation (processing 805). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0218] A control section 17 reads the sample hold value SHd changed by the analog-to-digital converter

18 until it starts 1 rotation timer TM 1 with which the time amount equivalent to one rotation of a write once optical disk 2 is set (processing 806) and this timer TM 1 carries out a time-out (processing 807, NO loop formation of decision 808). If the result of decision 808 is set to YES, the average value of the value of the sample hold value SHd then read is computed, and the result is saved as pit level **** at the time of the optimal record power (processing 809).

[0219] Thus, if the pit level **** at the time of the optimal record power (P0) is obtained, based on the formula (IV) mentioned above, the record condition desired value M0 is computed, and the computed record condition desired value M0 is saved (processing 810). With it, the detection temperature of a temperature sensor (illustration abbreviation) established suitably is inputted, and it saves as temperature TA (processing 811).

[0220] Next, a control section 17 sets up the value of a control signal WP so that record power may be made into a value only with the small predetermined minute value alpha (processing 812), and where the mode SPa which is in the condition and mentioned above actuation of the sample hold signal generator 15 is specified, it starts it (processing 813). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.

[0221] A control section 17 reads the sample hold value SHd changed by the analog-to-digital converter 18 until it starts 1 rotation timer TM 1 with which the time amount equivalent to one rotation of a write once optical disk 2 is set (processing 814) and this timer TM 1 carries out a time-out (processing 815, NO loop formation of decision 816). If the result of decision 816 is set to YES, the average value of the value of the sample hold value SHd then read is computed, and the result is saved as pit level **** at the time of real record power (processing 817).

[0222] Thus, if the pit level **** at the time of real record power (P1) is obtained, based on the formula (V) mentioned above, a reference value M1 is computed and the computed reference value M1 is saved (processing 818). Moreover, the detection temperature of a temperature sensor is inputted, it saves as temperature TB (processing 819), and the magnitude of a value beta is determined based on the difference of temperature TA and temperature TB (processing 820). In addition, as the decision approach of this value beta, for every range of the magnitude of the difference of temperature TA and temperature TB, it can ask for the magnitude of a value beta by experiment etc. beforehand, and the approach of determining based on that experimental value can be used, for example. Moreover, the function based on an experiment can be formed and it can also determine by using the function.

[0223] And it investigates whether the reference value M1 is larger than the record condition desired value M0 (decision 821). When the value of a control signal WP is set up so that record power P1 may be made into a value only with the large minute value alpha, when the result of decision 821 is set to YES (processing 822), and the result of decision 821 is set to NO, the value of a control signal WP is set up so that record power P1 may be made into a value only with the small predetermined minute value alpha (processing 823).

[0224] Thus, if processing 822,823 adjusts so that the record power P1 may be in the optimal record condition, it will investigate whether the value of the record power P1 after adjustment is larger than the value which applied the predetermined value beta (>alpha) to the optimal record power P0 (decision 824). Since the value after adjustment is an excessive value when the result of decision 824 is set to YES, the value of the record power P1 is set as the value which applied the predetermined value beta to the optimal record power P0 (processing 825), and return and record power of the following cycle are controlled to processing 813.

[0225] Moreover, when the result of decision 824 is set to NO, it investigates whether the value of the record power P1 after adjustment is smaller than the value which subtracted the predetermined value beta from the optimal record power P0 (decision 826). Since the value after adjustment is too little value when the result of decision 826 is set to YES, the value of the record power P1 is set as the value which subtracted the predetermined value beta from the optimal record power P0 (processing 827), and return and record power of the following cycle are controlled to processing 813.

[0226] Moreover, since the value of the record power P1 after adjustment is the case where it is

contained in the suitable range (P0**beta) when the result of decision 826 is set to NO, return and record power of the following cycle are controlled by the condition as it is to processing 813. And actuation to processing 813 - processing 827 is repeatedly performed during data-logging actuation.
[0227] Thus, in this example, since the value of beta is set up according to a temperature change while restricting the magnitude of the record power P1 to the predetermined range (P0**beta), the defect of a circuit etc. becomes a cause and the situation to which record actuation is carried out by extremely unusual power can be avoided.
[0228] In addition, this invention is applicable similarly about write once optical disk equipment like the so-called CD-R equipment. Moreover, although the example mentioned above explained the case where EFM was used as a data modulation technique, this invention is applicable similarly about the case where other data modulation techniques are used.
[0229]
[Effect of the Invention] Since it tries, writes and carries out in a test field before data logging, the optimal record power obtains and the inside of data logging is controlling real record power to be in the same record condition as the optimal record power according to this invention, as having explained above, even when the dependability of the recorded data improves and prolonged continuation record actuation is performed, the effectiveness that the stable record quality is acquired obtains.
[0230] Moreover, since it is carrying out based on the data equivalent to one rotation of a write once optical disk which carried out the period sampling in order to compute record condition desired value, the effect of dispersion in sampling data can be controlled, and the effectiveness that more reliable record power control can be performed is also acquired.
[0231] Moreover, since the data used in order to compute record condition desired value remove the data obtained from the defective field of a write once optical disk, they can control the effect of a medium defect, consequently acquire the effectiveness that more reliable record power control can be performed.
[0232] Moreover, since the sampling timing of the data used in order to compute record condition desired value is determined according to the write once optical disk then used, more suitable data can be obtained and the effectiveness that the dependability of data logging improves is also acquired.
[0233] Moreover, since the gain of adjustable gain amplifier is adjusted and level is adjusted to the suitable value when sampling data, suitable data can be obtained and the effectiveness that the dependability of data logging improves is also acquired.
[0234] Moreover, since the optimal record power is held when record condition desired value does not carry out monotone change according to record power, according to the property of a write once optical disk, the effectiveness that suitable record power control can be performed is acquired.
[0235] Moreover, since the magnitude of real record power is restricted to the predetermined range, the defect of a circuit etc. becomes a cause and the effectiveness that the situation to which record actuation is carried out by extremely unusual power is avoidable is acquired.
[0236] Moreover, in this example, since the value of beta is set up according to a temperature change while restricting the magnitude of real record power to the predetermined range (P0**beta), the defect of a circuit etc. becomes a cause and the effectiveness that the situation to which record actuation is carried out by extremely unusual power is avoidable is acquired.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention] This invention is equipped with the record power control means which controls the record power of the semiconductor laser component of the light source on a multistage story, a reflected light detection means detect the reflected light from the optical disk at the time of record, and an asymmetry detection means detect the asymmetry of the regenerative signal from an optical disk, and relates to the write once optical disk equipment which distinguishes the data-logging condition over an optical disk, and its control approach based on the detecting signal of the above-mentioned reflected light detection means at the time of record.

[Translation done.]

PRIOR ART

[Description of the Prior Art] Generally, since information could not record certainly when recording data on a write once optical disk, and the power of a laser beam was changed, the power at the time of record was controlled by write once optical disk equipment using a write once optical disk (for example, a WORM mold optical disk or CD-R (CD which can be written in (compact disc))) as a storage so that the reinforcement of a laser beam became fixed.
[0003] However, according to a cause as shown below, even if the reinforcement of a laser beam is fixed, the optimal pit configuration cannot be acquired. In addition, a pit (stoma) expresses the recording information formed in a write once optical disk.
[0004] - Change of the recording characteristic by wavelength change of the semiconductor laser component (light source component) by change and the temperature change of the property of the record medium by change and temperature changes, such as an inclination of the record medium to dispersion and optical system of the property of a record medium, [0005] Then, although indicated by the former, for example, JP,6-76288,A, like, a change of the reflected light from the record medium of a laser beam on the strength is detected at the time of record, and what is going to acquire the optimal pit configuration by changing the reinforcement of the laser beam which irradiates a record medium is proposed.
[0006] The following procedures are adopted by this conventional approach.
[0007] (i) A test data is recorded in the test field on a record medium (trying and writing field), changing the reinforcement of a laser beam. At this time, the reflected light reinforcement from a record medium is measured and memorized to coincidence. Moreover, reflected light reinforcement measures a thing the time (recording level (or pit level)) when the laser power at the time of pit formation is strong, and when laser power is weak (land level) if needed.
[0008] (ii) From the reflected light on-the-strength measurement result when recording by the laser beam to which asymmetry becomes the smallest, the desired value M of reflected light reinforcement is defined.
[0009] (iii) Reflected light reinforcement is measured recording actual data on a record medium, and the reinforcement of a laser beam is changed so that the value may be in agreement with desired value M.
[0010] It is the value calculated by the following formula (I) here using the amplitude value A by the side of plus, and the amplitude value B by the side of minus from the zero level of the amplitude of the regenerative signal when reproducing record data as asymmetry as shown in drawing 26 .
[0011]
(Asymmetry) =((B-A)/(B+A)) (/2) x100 (%)
... (I)
[0012] When asymmetry is small, it is a case with the good wave of a regenerative signal, and the stability of the processing when extracting data from a regenerative signal becomes [the difference of the amplitude value by the side of plus of a regenerative signal, and the amplitude value by the side of minus] few therefore good. Moreover, JP,6-76288,A is indicated that the optimum value of asymmetry is a value of -4-7(%).

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] Since it tries, writes and carries out in a test field before data logging, the optimal record power obtains and the inside of data logging is controlling real record power to be in the same record condition as the optimal record power according to this invention, as having explained above, even when the dependability of the recorded data improves and prolonged continuation record actuation is performed, the effectiveness that the stable record quality is acquired obtains.
[0230] Moreover, since it is carrying out based on the data equivalent to one rotation of a write once optical disk which carried out the period sampling in order to compute record condition desired value, the effect of dispersion in sampling data can be controlled, and the effectiveness that more reliable record power control can be performed is also acquired.
[0231] Moreover, since the data used in order to compute record condition desired value remove the data obtained from the defective field of a write once optical disk, they can control the effect of a medium defect, consequently acquire the effectiveness that more reliable record power control can be performed.
[0232] Moreover, since the sampling timing of the data used in order to compute record condition desired value is determined according to the write once optical disk then used, more suitable data can be obtained and the effectiveness that the dependability of data logging improves is also acquired.
[0233] Moreover, since the gain of adjustable gain amplifier is adjusted and level is adjusted to the suitable value when sampling data, suitable data can be obtained and the effectiveness that the dependability of data logging improves is also acquired.
[0234] Moreover, since the optimal record power is held when record condition desired value does not carry out monotone change according to record power, according to the property of a write once optical disk, the effectiveness that suitable record power control can be performed is acquired.
[0235] Moreover, since the magnitude of real record power is restricted to the predetermined range, the defect of a circuit etc. becomes a cause and the effectiveness that the situation to which record actuation is carried out by extremely unusual power is avoidable is acquired.
[0236] Moreover, in this example, since the value of beta is set up according to a temperature change while restricting the magnitude of real record power to the predetermined range (P0**beta), the defect of a circuit etc. becomes a cause and the effectiveness that the situation to which record actuation is carried out by extremely unusual power is avoidable is acquired.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, to equipment, it had produced following un-arranging such conventionally.
[0014] That is, conventionally, with equipment, since the test data was recorded on the test field, reflected light reinforcement was detected only at the time of data logging in the test field and it was made into desired value, the measurement count of reflected light reinforcement is limited, desired value M cannot be defined correctly, but it produces un-arranging [that a measurement result becomes unstable].
[0015] Moreover, in order to obtain many data in a short test field, a high-speed analog-to-digital converter is required, and since it needs a sample hold circuit and two analog-to-digital converters like equipment before especially in [that was mentioned above] asking for pit level and land level if needed, respectively, it also produces un-arranging [that equipment cost becomes high].
[0016] This invention is made in view of this actual condition, and aims at the stability of data logging offering good and cheap write once optical disk equipment and its control approach.

[Translation done.]

* NOTICES *

MEANS

[Means for Solving the Problem] The record power control means by which this invention controls the record power of the semiconductor laser component of the light source on a multistage story, It has a reflected light detection means to detect the reflected light from the optical disk at the time of record, and an asymmetry detection means to detect the asymmetry of the regenerative signal from an optical disk. In the write once optical disk equipment which distinguishes the data-logging condition over an optical disk based on the detecting signal of the above-mentioned reflected light detection means at the time of record In advance of actual data logging, to the test field set as the predetermined field of an optical disk When the test data which recorded the test data and was recorded for every record power is reproduced changing record power to a multistage story by the above-mentioned record power control means According to the asymmetry which the above-mentioned asymmetry detection means detected, the optimal record power at the time of data logging is determined. The inside of actual data logging Start data logging by the above-mentioned optimal record power, and record condition desired value is computed based on the detecting signal of the above-mentioned reflected light detection means immediately after data-logging initiation. The record power of the above-mentioned record power control means is adjusted so that the record condition characteristic computed based on the detecting signal of the above-mentioned reflected light detection means may be in agreement with the above-mentioned record condition desired value after it. Moreover, the record power control means which controls the record power of the semiconductor laser component of the light source on a multistage story, It has a reflected light detection means to detect the reflected light from the optical disk at the time of record, and an asymmetry detection means to detect the asymmetry of the regenerative signal from an optical disk. In the write once optical disk equipment which distinguishes the data-logging condition over an optical disk based on the detecting signal of the above-mentioned reflected light detection means at the time of record In advance of actual data logging, to the test field set as the predetermined field of an optical disk When the test data which recorded the test data and was recorded for every record power is reproduced changing record power to a multistage story by the above-mentioned record power control means According to the asymmetry which the above-mentioned asymmetry detection means detected, the optimal record power at the time of data logging is determined. The inside of actual data logging Start data logging by the above-mentioned optimal record power, and record condition desired value is computed based on two or more detecting signals immediately after data-logging initiation obtained from the above-mentioned reflected light detection means at least throughout [1 rotation term / of an optical disk]. The record power of the above-mentioned record power control means is adjusted so that the record condition characteristic computed based on the detecting signal of the above-mentioned reflected light detection means may be in agreement with the above-mentioned record condition desired value after it. Moreover, calculation of said record condition characteristic in data logging is good to carry out based on two or more detecting signals obtained from said reflected light detection means at least throughout [1 rotation term / of an optical disk].
[0018] Moreover, the record power control means which controls the record power of the semiconductor laser component of the light source on a multistage story, It has a reflected light detection means to

detect the reflected light from the optical disk at the time of record, and an asymmetry detection means to detect the asymmetry of the regenerative signal from an optical disk. In the write once optical disk equipment which distinguishes the data-logging condition over an optical disk based on the detecting signal of the above-mentioned reflected light detection means at the time of record It has a defective detection means to detect the defect produced in the optical disk based on the regenerative signal from an optical disk. In advance of actual data logging, to the test field set as the predetermined field of an optical disk When the test data which recorded the test data and was recorded for every record power is reproduced changing record power to a multistage story by the above-mentioned record power control means According to the asymmetry which the above-mentioned asymmetry detection means detected, the optimal record power at the time of data logging is determined. The inside of actual data logging The inside of the detecting signal which starts data logging by the above-mentioned optimal record power, and is obtained from the above-mentioned reflected light detection means immediately after data-logging initiation, Record condition desired value is computed based on the detecting signal of predetermined numbers other than what was obtained while the above-mentioned defective detection means detected the defect. The record power of the above-mentioned record power control means is adjusted so that the record condition characteristic computed based on the detecting signal of the above-mentioned reflected light detection means may be in agreement with the above-mentioned record condition desired value after it. Moreover, calculation of said record condition characteristic in data logging is good to carry out based on the detecting signal of predetermined numbers other than what was obtained while said defective detection means detected the defect among the detecting signals obtained from said reflected light detection means.

[0019] Moreover, the photo detector to which said reflected light detection means detects a reflected light signal and the sample hold circuit which samples the light-receiving signal of the above-mentioned photo detector, It has the sample hold signal generation circuit which changes the generating timing of the sampling signal of the above-mentioned sample hold circuit. The generating timing of the sampling signal of the above-mentioned sample hold circuit is changed by the above-mentioned sample hold signal generation circuit immediately after data-logging initiation. The generating timing of the sampling signal of the above-mentioned sample hold circuit is set as the generating timing of the above-mentioned sampling signal which detected the changing point of the signal outputted from the above-mentioned sample hold circuit.

[0020] Moreover, said reflected light detection means is equipped with the photo detector which detects a reflected light signal, the variable gain amplifier which amplifies the light-receiving signal of the above-mentioned photo detector, and the analog-to-digital converter which changes the output signal of the above-mentioned variable gain amplifier into a digital signal, and it adjusts the gain of the above-mentioned variable gain amplifier so that the output of the above-mentioned variable gain amplifier may become the value of the predetermined range immediately after data-logging initiation.

[0021] Moreover, the record power control means which controls the record power of the semiconductor laser component of the light source on a multistage story, It has a reflected light detection means to detect the reflected light from the optical disk at the time of record, and an asymmetry detection means to detect the asymmetry of the regenerative signal from an optical disk. In the write once optical disk equipment which distinguishes the data-logging condition over an optical disk based on the detecting signal of the above-mentioned reflected light detection means at the time of record In advance of actual data logging, to the test field set as the predetermined field of an optical disk When the test data which recorded the test data and was recorded for every record power is reproduced changing record power to a multistage story by the above-mentioned record power control means While setting the record power from which the asymmetry which the above-mentioned asymmetry detection means detected becomes min as the optimal record power at the time of data logging The characteristic showing the rate of the detecting signal of the above-mentioned reflected light detection means to record power When the existence of monotonicity which is changing in monotone according to change of record power is investigated and the above-mentioned monotonicity is judged to be **** The inside of actual data logging starts data logging by the above-mentioned optimal record power. So that record condition

desired value may be computed based on the detecting signal of the above-mentioned reflected light detection means immediately after data-logging initiation and the record condition characteristic computed based on the detecting signal of the above-mentioned reflected light detection means may be in agreement with the above-mentioned record condition desired value after it The record power of the above-mentioned record power control means is adjusted, and when it is judged that there is no above-mentioned monotonicity, the inside of actual data logging holds the above-mentioned optimal record power, and it is made to carry out data logging.

[0022] Moreover, the record power control means which controls the record power of the semiconductor laser component of the light source on a multistage story, It has a reflected light detection means to detect the reflected light from the optical disk at the time of record, and an asymmetry detection means to detect the asymmetry of the regenerative signal from an optical disk. In the write once optical disk equipment which distinguishes the data-logging condition over an optical disk based on the detecting signal of the above-mentioned reflected light detection means at the time of record In advance of actual data logging, to the test field set as the predetermined field of an optical disk When the test data which recorded the test data and was recorded for every record power is reproduced changing record power to a multistage story by the above-mentioned record power control means While setting the record power from which the asymmetry which the above-mentioned asymmetry detection means detected becomes min as the optimal record power at the time of data logging The characteristic showing the rate of the detecting signal of the above-mentioned reflected light detection means to record power When the existence of monotonicity which is changing in monotone according to change of record power is investigated and the above-mentioned monotonicity is judged to be **** The inside of actual data logging starts data logging by the above-mentioned optimal record power. Record condition desired value is computed based on two or more detecting signals immediately after data-logging initiation obtained from the above-mentioned reflected light detection means at least throughout [1 rotation term / of an optical disk]. So that the record condition characteristic computed based on the detecting signal of the above-mentioned reflected light detection means may be in agreement with the above-mentioned record condition desired value after it The record power of the above-mentioned record power control means is adjusted, and when it is judged that there is no above-mentioned monotonicity, the inside of actual data logging holds the above-mentioned optimal record power, and it is made to carry out data logging.

[0023] Moreover, the record power control means which controls the record power of the semiconductor laser component of the light source on a multistage story, It has a reflected light detection means to detect the reflected light from the optical disk at the time of record, and an asymmetry detection means to detect the asymmetry of the regenerative signal from an optical disk. In the write once optical disk equipment which distinguishes the data-logging condition over an optical disk based on the detecting signal of the above-mentioned reflected light detection means at the time of record It has a defective detection means to detect the defect produced in the optical disk based on the regenerative signal from an optical disk. In advance of actual data logging, to the test field set as the predetermined field of an optical disk When the test data which recorded the test data and was recorded for every record power is reproduced changing record power to a multistage story by the above-mentioned record power control means While setting the record power from which the asymmetry which the above-mentioned asymmetry detection means detected becomes min as the optimal record power at the time of data logging The characteristic showing the rate of the detecting signal of the above-mentioned reflected light detection means to record power When the existence of monotonicity which is changing in monotone according to change of record power is investigated and the above-mentioned monotonicity is judged to be **** The inside of actual data logging starts data logging by the above-mentioned optimal record power. The inside of the detecting signal obtained from the above-mentioned reflected light detection means immediately after data-logging initiation, Record condition desired value is computed based on the detecting signal of predetermined numbers other than what was obtained while the above-mentioned defective detection means detected the defect. So that the record condition characteristic computed based on the detecting signal of the above-mentioned reflected light detection means may be in

agreement with the above-mentioned record condition desired value after it The record power of the above-mentioned record power control means is adjusted, and when it is judged that there is no above-mentioned monotonicity, the inside of actual data logging holds the above-mentioned optimal record power, and it is made to carry out data logging. Moreover, change of said record power is good to make it restrict within the limits of predetermined. Moreover, after the limit range of said record power sets up said optimal record power, it is good to set up based on the temperature change of the time of computing a record condition characteristic.

[0024] Moreover, based on the magnitude of the reflected light at the time of record, it sets to the control approach of the write once optical disk equipment which distinguishes the data-logging condition over an optical disk. When the test data which recorded the test data on the test field set as the predetermined field of an optical disk, changing record power to a multistage story, and was recorded on it for every record power is reproduced in advance of actual data logging According to the asymmetry of the regenerative signal, the optimal record power at the time of data logging is determined. The inside of actual data logging Start data logging by the above-mentioned optimal record power, and record condition desired value is computed based on the reflected light from the optical disk detected immediately after data-logging initiation. Based on the reflected light, a record condition characteristic is computed from an optical disk after it to proper timing, and record power is adjusted so that the computed record condition characteristic may be in agreement with the above-mentioned record condition desired value.

[0025] Moreover, based on the magnitude of the reflected light at the time of record, it sets to the control approach of the write once optical disk equipment which distinguishes the data-logging condition over an optical disk. When the test data which recorded the test data on the test field set as the predetermined field of an optical disk, changing record power to a multistage story, and was recorded on it for every record power is reproduced in advance of actual data logging According to the asymmetry of the regenerative signal, the optimal record power at the time of data logging is determined. The inside of actual data logging Start data logging by the above-mentioned optimal record power, and record condition desired value is computed based on the reflected light from the optical disk immediately after data-logging initiation detected at least throughout [1 rotation term / of an optical disk]. Record power is adjusted so that the record condition characteristic computed based on the reflected light from an optical disk may be in agreement with the above-mentioned record condition desired value after it.

[0026] Moreover, based on the magnitude of the reflected light at the time of record, it sets to the control approach of the write once optical disk equipment which distinguishes the data-logging condition over an optical disk. When the test data which recorded the test data on the test field set as the predetermined field of an optical disk, changing record power to a multistage story, and was recorded on it for every record power is reproduced in advance of actual data logging According to the asymmetry of the regenerative signal, the optimal record power at the time of data logging is determined. The inside of actual data logging Data logging is started by the above-mentioned optimal record power. Immediately after data-logging initiation Record condition desired value is computed based on the reflected light from the optical disk obtained from the field without a defect, and after it, record power is adjusted so that the record condition characteristic computed based on the reflected light from an optical disk may be in agreement with the above-mentioned record condition desired value.

[0027] Moreover, based on the magnitude of the reflected light at the time of record, it sets to the control approach of the write once optical disk equipment which distinguishes the data-logging condition over an optical disk. When the test data which recorded the test data on the test field set as the predetermined field of an optical disk, changing record power to a multistage story, and was recorded on it for every record power is reproduced in advance of actual data logging While setting the record power from which the asymmetry of the regenerative signal becomes min as the optimal record power at the time of data logging The characteristic showing the rate of the detecting signal of the above-mentioned reflected light detection means to record power When the existence of monotonicity which is changing in monotone according to change of record power is investigated and the above-mentioned monotonicity is judged to be **** The inside of actual data logging starts data logging by the above-mentioned optimal record

power. Based on the reflected light, record condition desired value is computed from the optical disk detected immediately after data-logging initiation. So that a record condition characteristic may be computed from an optical disk after it based on the reflected light to proper timing and the computed record condition characteristic may be in agreement with the above-mentioned record condition desired value Record power is adjusted, and when it is judged that there is no above-mentioned monotonicity, the inside of actual data logging holds the above-mentioned optimal record power, and it is made to carry out data logging.

[0028] Moreover, based on the magnitude of the reflected light at the time of record, it sets to the control approach of the write once optical disk equipment which distinguishes the data-logging condition over an optical disk. When the test data which recorded the test data on the test field set as the predetermined field of an optical disk, changing record power to a multistage story, and was recorded on it for every record power is reproduced in advance of actual data logging While setting the record power from which the asymmetry of the regenerative signal becomes min as the optimal record power at the time of data logging The characteristic showing the rate of the detecting signal of the above-mentioned reflected light detection means to record power When the existence of monotonicity which is changing in monotone according to change of record power is investigated and the above-mentioned monotonicity is judged to be **** The inside of actual data logging starts data logging by the above-mentioned optimal record power. Record condition desired value is computed based on the reflected light from the optical disk immediately after data-logging initiation detected at least throughout [1 rotation term / of an optical disk]. When it is judged that record power is adjusted and there is no above-mentioned monotonicity so that the record condition characteristic computed based on the reflected light from an optical disk may be in agreement with the above-mentioned record condition desired value after it The inside of actual data logging holds the above-mentioned optimal record power, and it is made to carry out data logging.

[0029] Moreover, based on the magnitude of the reflected light at the time of record, it sets to the control approach of the write once optical disk equipment which distinguishes the data-logging condition over an optical disk. When the test data which recorded the test data on the test field set as the predetermined field of an optical disk, changing record power to a multistage story, and was recorded on it for every record power is reproduced in advance of actual data logging While setting the record power from which the asymmetry of the regenerative signal becomes min as the optimal record power at the time of data logging The characteristic showing the rate of the detecting signal of the above-mentioned reflected light detection means to record power When the existence of monotonicity which is changing in monotone according to change of record power is investigated and the above-mentioned monotonicity is judged to be **** The inside of actual data logging starts data logging by the above-mentioned optimal record power. So that the record condition characteristic which computed record condition desired value based on the reflected light from the optical disk obtained from the field without a defect, and was computed after it immediately after data-logging initiation based on the reflected light from an optical disk may be in agreement with the above-mentioned record condition desired value Record power is adjusted, and when it is judged that there is no above-mentioned monotonicity, the inside of actual data logging holds the above-mentioned optimal record power, and it is made to carry out data logging.

[0030]

[Embodiment of the Invention] Hereafter, the example of this invention is explained to a detail, referring to an accompanying drawing.

[0031] Drawing 1 shows the important section of the write once optical disk equipment concerning one example of this invention.

[0032] In this drawing, optical pickup equipment 1 is for reproducing data from a write once optical disk 2, while recording data on a write once optical disk 2, and the photo detector 6 for signal detection for detecting the photo detector 5 for output monitors for detecting the output level of the semiconductor laser component 4 used as the light source and the semiconductor laser component 4 and the reflected light from a write once optical disk 2 is formed in the optical head 3. In addition, the tracking control means (illustration abbreviation) for making the laser beam of the focusing control means (illustration abbreviation) for uniting a focus with a recording track for the laser beam of the optical head 3 or an

optical head follow a recording track etc. is attached to optical pickup equipment 1. Moreover, the seeking device (illustration abbreviation) which carries out both-way migration of the optical head 3 radial [of a write once optical disk 2] is also prepared in optical pickup equipment 1.

[0033] After the monitor light-receiving signal Pm outputted from the photo detector 5 for output monitors is changed into a voltage signal through a current / electrical-potential-difference conversion amplifier 8, it is added to the playback power control section 9 and the record power control section 10.

[0034] It is outputted to next step equipment as a regenerative signal RF while it is added to a sample / hold circuit 12, and the asymmetry judging circuit 13, after the signal light-receiving signal Pa outputted from the photo detector 6 for signal detection is changed into a voltage signal through a current / electrical-potential-difference conversion amplifier 11.

[0035] The record data DE which are added from a well-known record data generating means (illustration abbreviation) and by which the EFM (Eight to Fourteen Modulation) modulation was carried out are added to the sample hold signal generator 15 and the delay circuit 16.

[0036] The sample hold signal generator 15 is a mode according to mode signal MS added from a control section 17, the sampling signal SP is outputted to the timing which has gone through the predetermined sampling time from the standup timing of the record data DE, and the sampling signal SP is added to the sample / hold circuit 12.

[0037] Thereby, a sample / hold circuit 12 samples the signal added to the timing (for example, rising edge of the sampling signal SP) to which the sampling signal SP is added, and outputs it to an analog-to-digital converter 18 by making the sampling result into the sample hold value SH.

[0038] An analog-to-digital converter 18 changes the sample hold value SH applied into a corresponding digital signal, and the output signal is applied to the control section 17 as a sample hold value SHd.

[0039] A delay circuit 16 delays the record data DE added predetermined delay time, and the output signal is applied to the control section 17 and LD (semiconductor laser component) drive circuit 20 as record data DEd.

[0040] A control section 17 controls actuation of this write once optical disk equipment, forms the control signal RP for specifying the output at the time of playback of the semiconductor laser component 4, and the control signal WP which specifies the output at the time of record of the semiconductor laser component 4, and outputs these control signals RP and a control signal WP to a digital to analog converter 21 and a digital to analog converter 22, respectively.

[0041] A digital to analog converter 21 changes the control signal RP added into a corresponding analog signal, and the output signal is applied to the playback power control section 9 as a control signal RPa.

[0042] A digital to analog converter 22 changes the control signal WP added into a corresponding analog signal, and the output signal is applied to the record power control section 10 as a control signal WPa.

[0043] The playback power control section 9 outputs the playback power signal SSr which specifies the output at the time of playback of the semiconductor laser component 4 to the LD mechanical component 20 so that the magnitude of the monitor light-receiving signal Pm may be in agreement with the magnitude of a control signal RPa.

[0044] The record power control section 10 outputs the record power signal SSw which specifies the output at the time of record of the semiconductor laser component 4 to the LD mechanical component 20 so that the magnitude of the monitor light-receiving signal Pm may be in agreement with the magnitude of a control signal WPa.

[0045] In the condition that the record data DEd are a mark state (logic H level), the LD mechanical component 20 drives the semiconductor laser component 4 with the output specified by the playback power signal SSr by the condition that the record data DEd are a non-mark state (logic L level) while driving the semiconductor laser component 4 with the output specified by the record power signal SSw. That is, the LD mechanical component 20 switches the output of the semiconductor laser component 4 to a high speed at the record power corresponding to the record power signal SSw, and the playback power corresponding to the playback power signal SSr based on the record data DEd.

[0046] Thereby, according to the record data DE, the output of the semiconductor laser component 4 changes to record power and playback power, consequently data are recorded on the recording track of a write once optical disk 2.
[0047] Moreover, it computes asymmetry by the asymmetry judging circuit 13 detecting the amplitude value by the side of plus, and the amplitude value by the side of minus from the zero level of the regenerative signal RF added, and calculating the formula (I) mentioned above based on those amplitude value, and the calculation result is added to the control section 17 as an asymmetry signal ST.
[0048] Moreover, a control section 17 exchanges data various between the external devices (for example, personal computer equipment etc.) using this write once optical disk equipment as external storage while it exchanges other elements of this write once optical disk equipment, and various data and supervises and controls actuation of those elements.
[0049] With the above configuration, when carrying out data logging of the control section 17, it performs actuation shown in drawing 2 and drawing 3 .
[0050] First, seeking to the predetermined test field beforehand set as the write once optical disk 2, changing a control signal WP to a multistage story, and carrying out sequential change of the record power of the semiconductor laser component 4, it is made to generate from the record data generating means (illustration abbreviation) of common knowledge of the record data DE of a predetermined test data, and data write-in actuation of the predetermined amount of data is performed about each record power (processing 101).
[0051] Subsequently, the asymmetry signal ST which carried out sequential playback and inputted the test data recorded by each record power from the asymmetry judging circuit 13 at the time of the playback is saved, and the asymmetry signal ST for every record power is acquired (processing 102).
[0052] And the value of the asymmetry signal ST judges the record power which takes the minimum value, sets the value of the record power as the optimal record power P0 (processing 103), and where the value corresponding to the optimal record power P0 is set to a control signal WP, it starts actual data-logging actuation (processing 104).
[0053] Where Mode SPa is specified, actuation of the sample hold signal generator 15 is started at the same time it starts the data-logging actuation (processing 105). Here, as shown in drawing 4 (a) and (b), after the record data DE start to a mark state, when Mode SPa goes through predetermined time t1, it is a mode of operation which outputs the sample hold signal SP. Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0054] If the sample hold value SHd changed by the analog-to-digital converter 18 is read (processing 106) and the read number turns into a predetermined number, a control section 17 computes the average value of the sample hold value SHd of the read predetermined number, and saves the result as pit level **** at the time of the optimal record power (processing 107).
[0055] Next, a timing change of the actuation of the sample hold signal generator 15 is made at Mode SPb (processing 108). Here, as shown in drawing 4 (c), after the record data DE fall to a non-mark state, when Mode SPb goes through predetermined time t1, it is a mode of operation which outputs the sample hold signal SP. Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period brought down by playback power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0056] If the sample hold value SHd changed by the analog-to-digital converter 18 is read (processing 109) and the read number turns into a predetermined number, a control section 17 computes the average value of the sample hold value SHd of the read predetermined number, and saves the result as land level Vb at the time of the optimal record power (processing 110).
[0057] Thus, if the pit level **** and the land level Vb at the time of the optimal record power (P0) are obtained, based on the following formula (II), the record condition desired value M0 is computed, and the computed record condition desired value M0 is saved (processing 111).
[0058]
M0=****/(P0xVb) (II) [0059] Next, a control section 17 sets up the value of a control signal WP so that

record power may be made into a value only with the small predetermined minute value alpha (processing 112). And a timing change of the actuation of the sample hold signal generator 15 is made at Mode SPa (processing 113). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0060] If the sample hold value SHd changed by the analog-to-digital converter 18 is read (processing 114) and the read number turns into a predetermined number, a control section 17 computes the average value of the sample hold value SHd of the read predetermined number, and saves the result as pit level **** at the time of real record power (processing 115).
[0061] Next, a control section 17 makes a timing change of the actuation of the sample hold signal generator 15 at Mode SPb (processing 116). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period brought down by playback power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0062] If the sample hold value SHd changed by the analog-to-digital converter 18 is read (processing 117) and the read number turns into a predetermined number, a control section 17 computes the average value of the sample hold value SHd of the read predetermined number, and saves the result as land level Vb at the time of real record power (processing 118).
[0063] Thus, if the pit level **** and the land level Vb at the time of real record power (P1) are obtained, a reference value M1 will be computed based on the following formula (III) (processing 119).
[0064]
M1=****/(P1xVb) (II) [0065] And it investigates whether the reference value M1 is larger than the record condition desired value M0 (decision 120). When the value of a control signal WP is set up so that record power may be made into a value only with the large minute value alpha, when the result of decision 120 is set to YES (processing 121), and the result of decision 120 is set to NO, the value of a control signal WP is set up so that record power may be made into a value only with the small predetermined minute value alpha (processing 122). Thus, if it adjusts so that record power may be in the optimal record condition, return and record power of the following cycle will be controlled by processing 121,122 to processing 113. And actuation to processing 113 - processing 122 is repeatedly performed during data-logging actuation.
[0066] Thus, since it tries, writes and carries out in a test field before data logging, the optimal record power P0 is obtained and the inside of data logging is controlling the real record power P1 by this example to be in the same record condition as the optimal record power P0, even when the dependability of the recorded data improves and prolonged continuation record actuation is performed, the stable record quality is acquired.
[0067] Drawing 5 (a) and (b) show other examples of the processing at the time of data logging. In addition, the control section 17 of the equipment shown in drawing 1 performs this processing.
[0068] First, seeking to the predetermined test field beforehand set as the write once optical disk 2, changing a control signal WP to a multistage story, and carrying out sequential change of the record power of the semiconductor laser component 4, it is made to generate from the record data generating means (illustration abbreviation) of common knowledge of the record data DE of a predetermined test data, and data write-in actuation of the predetermined amount of data is performed about each record power (processing 201).
[0069] Subsequently, the asymmetry signal ST which carried out sequential playback and inputted the test data recorded by each record power from the asymmetry judging circuit 13 at the time of the playback is saved, and the asymmetry signal ST for every record power is acquired (processing 202).
[0070] And the value of the asymmetry signal ST judges the record power which takes the minimum value, sets the value of the record power as the optimal record power P0 (processing 203), and where the value corresponding to the optimal record power P0 is set to a control signal WP, it starts actual data-logging actuation (processing 204).
[0071] Where Mode SPa is specified, actuation of the sample hold signal generator 15 is started at the same time it starts the data-logging actuation (processing 205). Thereby, the semiconductor laser

component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0072] A control section 17 reads the sample hold value SHd changed by the analog-to-digital converter 18 until it starts 1 rotation timer TM 1 with which the time amount equivalent to one rotation of a write once optical disk 2 is set (processing 206) and this timer TM 1 carries out a time-out (processing 207, NO loop formation of decision 208). If the result of decision 208 is set to YES, the average value of the value of the sample hold value SHd then read is computed, and the result is saved as pit level **** at the time of the optimal record power (processing 209).
[0073] Thus, if the pit level **** at the time of the optimal record power (P0) is obtained, based on the following formula (IV), the record condition desired value M0 is computed, and the computed record condition desired value M0 is saved (processing 210).
[0074]
M0=****/P0 (IV) [0075] Next, a control section 17 sets up the value of a control signal WP so that record power may be made into a value only with the small predetermined minute value alpha (processing 211), and it is in the condition, and actuation of the sample hold signal generator 15 is started where Mode SPa is specified (processing 212). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0076] A control section 17 reads the sample hold value SHd changed by the analog-to-digital converter 18 until it starts 1 rotation timer TM 1 with which the time amount equivalent to one rotation of a write once optical disk 2 is set (processing 213) and this timer TM 1 carries out a time-out (processing 214, NO loop formation of decision 215). If the result of decision 215 is set to YES, the average value of the value of the sample hold value SHd then read is computed, and the result is saved as pit level **** at the time of real record power (processing 216).
[0077] Thus, if the pit level **** at the time of real record power (P1) is obtained, based on the following formula (V), a reference value M1 is computed and the computed reference value M1 is saved (processing 217).
[0078]
M1=****/P1 (V) [0079] And it investigates whether the reference value M1 is larger than the record condition desired value M0 (decision 218). When the value of a control signal WP is set up so that record power may be made into a value only with the large minute value alpha, when the result of decision 218 is set to YES (processing 218), and the result of decision 218 is set to NO, the value of a control signal WP is set up so that record power may be made into a value only with the small predetermined minute value alpha (processing 220). Thus, if it adjusts so that record power may be in the optimal record condition, return and record power of the following cycle will be controlled by processing 219,220 to processing 212. And actuation to processing 212 - processing 220 is repeatedly performed during data-logging actuation.
[0080] Thus, since it tries, writes and carries out in a test field before data logging, the optimal record power P0 is obtained and the inside of data logging is controlling the real record power P1 by this example to be in the same record condition as the optimal record power P0, even when the dependability of the recorded data improves and prolonged continuation record actuation is performed, the stable record quality is acquired.
[0081] Moreover, since it is carrying out based on the data equivalent to one rotation of a write once optical disk 2 which carried out the period sampling in order to compute the record condition desired value M0, the effect of dispersion in sampling data can be controlled, and more reliable record power control can be performed.
[0082] Drawing 6 shows the important section of the write once optical disk equipment concerning other examples of this invention. In addition, in this drawing, the same sign is given to the same part as drawing 1 , and the corresponding part.
[0083] In this drawing, optical pickup equipment 1 is for reproducing data from a write once optical disk 2, while recording data on a write once optical disk 2, and the photo detector 6 for signal detection for

detecting the photo detector 5 for output monitors for detecting the output level of the semiconductor laser component 4 used as the light source and the semiconductor laser component 4 and the reflected light from a write once optical disk 2 is formed in the optical head 3. In addition, the tracking control means (illustration abbreviation) for making the laser beam of the focusing control means (illustration abbreviation) for uniting a focus with a recording track for the laser beam of the optical head 3 or an optical head follow a recording track etc. is attached to optical pickup equipment 1. Moreover, the seeking device (illustration abbreviation) which carries out both-way migration of the optical head 3 radial [of a write once optical disk 2] is also prepared in optical pickup equipment 1.

[0084] After the monitor light-receiving signal Pm outputted from the photo detector 5 for output monitors is changed into a voltage signal through a current / electrical-potential-difference conversion amplifier 8, it is added to the playback power control section 9 and the record power control section 10.

[0085] It is outputted to next step equipment as a regenerative signal RF while it is added to a sample / hold circuit 12, the asymmetry judging circuit 13, and the defective detector 25, after the signal light-receiving signal Pa outputted from the photo detector 6 for signal detection is changed into a voltage signal through a current / electrical-potential-difference conversion amplifier 11.

[0086] The record data DE which are added from a well-known record data generating means (illustration abbreviation) and by which the EFM (Eight to Fourteen Modulation) modulation was carried out are added to the sample hold signal generator 15 and the delay circuit 16.

[0087] The sample hold signal generator 15 is a mode according to mode signal MS added from a control section 17, the sampling signal SP is outputted to the timing which has gone through the predetermined sampling time from the standup timing of the record data DE, and the sampling signal SP is added to the sample / hold circuit 12.

[0088] Thereby, a sample / hold circuit 12 samples the signal added to the timing (for example, rising edge of the sampling signal SP) to which the sampling signal SP is added, and outputs it to an analog-to-digital converter 18 by making the sampling result into the sample hold value SH.

[0089] An analog-to-digital converter 18 changes the sample hold value SH applied into a corresponding digital signal, and the output signal is applied to the control section 17 as a sample hold value SHd.

[0090] A delay circuit 16 delays the record data DE added predetermined delay time, and the output signal is applied to the control section 17 and LD (semiconductor laser component) drive circuit 20 as record data DEd.

[0091] A control section 17 controls actuation of this write once optical disk equipment, forms the control signal RP for specifying the output at the time of playback of the semiconductor laser component 4, and the control signal WP which specifies the output at the time of record of the semiconductor laser component 4, and outputs these control signals RP and a control signal WP to a digital to analog converter 21 and a digital to analog converter 22, respectively.

[0092] A digital to analog converter 21 changes the control signal RP added into a corresponding analog signal, and the output signal is applied to the playback power control section 9 as a control signal RPa.

[0093] A digital to analog converter 22 changes the control signal WP added into a corresponding analog signal, and the output signal is applied to the record power control section 10 as a control signal WPa.

[0094] The playback power control section 9 outputs the playback power signal SSr which specifies the output at the time of playback of the semiconductor laser component 4 to the LD mechanical component 20 so that the magnitude of the monitor light-receiving signal Pm may be in agreement with the magnitude of a control signal RPa.

[0095] The record power control section 10 outputs the record power signal SSw which specifies the output at the time of record of the semiconductor laser component 4 to the LD mechanical component 20 so that the magnitude of the monitor light-receiving signal Pm may be in agreement with the magnitude of a control signal WPa.

[0096] In the condition that the record data DEd are a mark state (logic H level), the LD mechanical component 20 drives the semiconductor laser component 4 with the output specified by the playback

power signal SSr by the condition that the record data DEd are a non-mark state (logic L level) while driving the semiconductor laser component 4 with the output specified by the record power signal SSw. That is, the LD mechanical component 20 switches the output of the semiconductor laser component 4 to a high speed at the record power corresponding to the record power signal SSw, and the playback power corresponding to the playback power signal SSr based on the record data DEd.
[0097] Thereby, according to the record data DE, the output of the semiconductor laser component 4 changes to record power and playback power, consequently data are recorded on the recording track of a write once optical disk 2.
[0098] Moreover, it computes asymmetry by the asymmetry judging circuit 13 detecting the amplitude value by the side of plus, and the amplitude value by the side of minus from the zero level of the regenerative signal RF added, and calculating the formula (I) mentioned above based on those amplitude value, and the calculation result is added to the control section 17 as an asymmetry signal ST.
[0099] Moreover, a control section 17 exchanges data various between the external devices (for example, personal computer equipment etc.) using this write once optical disk equipment as external storage while it exchanges other elements of this write once optical disk equipment, and various data and supervises and controls actuation of those elements.
[0100] Moreover, when the defective detector 25 detects the medium defect produced in the write once optical disk 2 and the condition below a predetermined value continues [for example, / the level of a regenerative signal RF] beyond predetermined time (for example, about several microseconds), it judges with having detected the medium defect. And detection of a medium defect outputs the defective detecting signal DD to a control section 17.
[0101] Drawing 7 and drawing 8 show the example of processing which the control section 17 of the equipment of drawing 6 performs at the time of data logging.
[0102] First, seeking to the predetermined test field beforehand set as the write once optical disk 2, changing a control signal WP to a multistage story, and carrying out sequential change of the record power of the semiconductor laser component 4, it is made to generate from the record data generating means of common knowledge of the record data DE of a predetermined test data, and data write-in actuation of the predetermined amount of data is performed about each record power (processing 301).
[0103] Subsequently, the asymmetry signal ST which carried out sequential playback and inputted the test data recorded by each record power from the asymmetry judging circuit 13 at the time of the playback is saved, and the asymmetry signal ST for every record power is acquired (processing 302).
[0104] And the value of the asymmetry signal ST judges the record power which takes the minimum value, sets the value of the record power as the optimal record power P0 (processing 303), and where the value corresponding to the optimal record power P0 is set to a control signal WP, it starts actual data-logging actuation (processing 304).
[0105] Where Mode SPa is specified, actuation of the sample hold signal generator 15 is started at the same time it starts the data-logging actuation (processing 305). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0106] A control section 17 reads the sample hold value SHd changed by the analog-to-digital converter 18 (processing 306), and investigates whether the defective detecting signal DD is then outputted (decision 307). When the result of decision 307 is set to YES, since it obtains from the field which the medium defect has produced, the sample hold value SHd inputted immediately before cancels the sample hold value SHd inputted just before that (processing 308), and reads return and the following sample hold value SHd into processing 306.
[0107] Moreover, since suitable data are obtained when the result of decision 307 is set to NO, when it investigates whether the sampling of the data of a predetermined number was completed (decision 309) and the result of decision 309 is set to NO, return and the following sample hold value SHd are read into processing 306.
[0108] When the result of decision 309 is set to YES, the average value of the value of the sample hold value SHd of the predetermined number then read and obtained is computed, the result is made into the

pit level **** at the time of the optimal record power, based on the formula (IV) mentioned above, the record condition desired value M0 is computed, and the computed record condition desired value M0 is saved (processing 310).
[0109] Next, a control section 17 sets up the value of a control signal WP so that record power may be made into a value only with the small predetermined minute value alpha (processing 311), and it is in the condition, and actuation of the sample hold signal generator 15 is started where Mode SPa is specified (processing 312). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0110] A control section 17 reads the sample hold value SHd changed by the analog-to-digital converter 18 (processing 313), and investigates whether the defective detecting signal DD is then outputted (decision 314). When the result of decision 314 is set to YES, since it obtains from the field which the medium defect has produced, the sample hold value SHd inputted immediately before cancels the sample hold value SHd inputted just before that (processing 315), and reads return and the following sample hold value SHd into processing 313.
[0111] Moreover, since suitable data are obtained when the result of decision 314 is set to NO, when it investigates whether the sampling of the data of a predetermined number was completed (decision 316) and the result of decision 316 is set to NO, return and the following sample hold value SHd are read into processing 312.
[0112] When the result of decision 316 is set to YES, the average value of the value of the sample hold value SHd of the predetermined number then read and obtained is computed, the result is made into the pit level **** at the time of real record power (P1) (processing 317), based on the formula (V) mentioned above, a reference value M1 is computed and the computed reference value M1 is saved (processing 318).
[0113] And it investigates whether the reference value M1 is larger than the record condition desired value M0 (decision 319). When the value of a control signal WP is set up so that record power may be made into a value only with the large minute value alpha, when the result of decision 319 is set to YES (processing 320), and the result of decision 319 is set to NO, the value of a control signal WP is set up so that record power may be made into a value only with the small predetermined minute value alpha (processing 321). Thus, if it adjusts so that record power may be in the optimal record condition, return and record power of the following cycle will be controlled by processing 320,321 to processing 312. And actuation to processing 312 - processing 321 is repeatedly performed during data-logging actuation.

[0114] Thus, since it tries, writes and carries out in a test field before data logging, the optimal record power P0 is obtained and the inside of data logging is controlling the real record power P1 by this example to be in the same record condition as the optimal record power P0, even when the dependability of the recorded data improves and prolonged continuation record actuation is performed, the stable record quality is acquired.
[0115] Moreover, since the data used in order to compute the record condition desired value M0 remove the data obtained from the defective field of a write once optical disk 2, they can control the effect of a medium defect, consequently can perform more reliable record power control.
[0116] Now, the reflected light reinforcement from a write once optical disk 2 changes, as shown in drawing 9 . It is a wave when the semiconductor laser component 4 drives from 0T pit location by record power up to 11T pit location here, and other parts are waves when the semiconductor laser component 4 drives by playback power. Moreover, reflected light reinforcement serves as peak value just behind 0T pit location because the recording surface of a write once optical disk 2 is a mirror plane, by irradiating the laser beam of record power continuously, a pit is formed and, thereby, reflected light reinforcement falls.
[0117] In this case, the timing which samples the signal of the pit level **** will be shown in drawing by reflected light reinforcement when the difference in the property by the difference in the media of a write once optical disk 2 becomes a cause and carries out data logging in the state of optimal record with

a broken line, although 4T pit location has been criteria. In this case, a sampling value with better sampling the pit level **** to the timing before 4T pit location may be able to be acquired. In addition, the sampling timing of the land level Vb is timing as shown in drawing.
[0118] Then, if change gradually the sampling timing of the sample signal SP given to a sample / hold circuit 12, the pit level **** is detected, the changing point (refer to drawing 11) of level change of the pit level **** is searched for and the sampling timing immediately after the changing point is set as the sampling timing of the write once optical disk 2 as shown in drawing 10 (a) - (d), the better pit level **** is detectable.
[0119] Drawing 12 and drawing 13 show an example of the data-logging processing in this case. In addition, this processing is processing which the control section 17 of the equipment shown in drawing 6 performs.
[0120] First, seeking to the predetermined test field beforehand set as the write once optical disk 2, changing a control signal WP to a multistage story, and carrying out sequential change of the record power of the semiconductor laser component 4, it is made to generate from the record data generating means of common knowledge of the record data DE of a predetermined test data, and data write-in actuation of the predetermined amount of data is performed about each record power (processing 401).
[0121] Subsequently, the asymmetry signal ST which carried out sequential playback and inputted the test data recorded by each record power from the asymmetry judging circuit 13 at the time of the playback is saved, and the asymmetry signal ST for every record power is acquired (processing 402).
[0122] And the value of the asymmetry signal ST judges the record power which takes the minimum value, sets the value of the record power as the optimal record power P0 (processing 403), and where the value corresponding to the optimal record power P0 is set to a control signal WP, it starts actual data-logging actuation (processing 404).
[0123] It is set as the condition of expressing the sampling timing which is not performing the mode of operation of the sample hold signal generator 15 then (processing 405), and the sampling action of the set-up sampling timing is started at the same time it starts the data-logging actuation (processing 406). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power to the sampling timing then set up, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0124] A control section 17 computes the average of predetermined number reading (processing 407) and its read sample hold value SHd, and saves the sample hold value SHd changed by the analog-to-digital converter 18 as pit level **** corresponding to the sampling timing for the computed average (processing 408).
[0125] And when it investigates whether the pit level **** about all sampling timing was obtained (decision 409) and the result of decision 409 is set to NO, the pit level **** is formed in processing 405 about return and the following sampling timing.
[0126] Moreover, when the result of decision 409 is set to YES, the pit level **** then saved is investigated in order of sampling timing, the changing point of the pit level **** is judged, it determines as sampling timing which uses the sampling timing of the judged changing point then, and the mode of operation of the sampling timing is set as the sample hold signal generator 15 (processing 410). Thereby, to the sampling timing near [which was then judged] a changing point, a sample / hold circuit 12 samples the signal light-receiving signal Pa, and outputs it as a sample hold value SH.
[0127] Thus, if sampling timing is determined, a control section 17 will read the sample hold value SHd changed by the analog-to-digital converter 18 (processing 411), and will investigate whether the defective detecting signal DD is then outputted (decision 412). When the result of decision 412 is set to YES, since it obtains from the field which the medium defect has produced, the sample hold value SHd inputted immediately before cancels the sample hold value SHd inputted just before that (processing 413), and reads return and the following sample hold value SHd into processing 411.
[0128] Moreover, since suitable data are obtained when the result of decision 412 is set to NO, when it investigates whether the sampling of the data of a predetermined number was completed (decision 414) and the result of decision 414 is set to NO, return and the following sample hold value SHd are read into

processing 411.
[0129] When the result of decision 414 is set to YES, the average value of the value of the sample hold value SHd of the predetermined number then read and obtained is computed, the result is made into the pit level **** at the time of the optimal record power, based on the formula (IV) mentioned above, the record condition desired value M0 is computed, and the computed record condition desired value M0 is saved (processing 415).
[0130] Next, a control section 17 sets up the value of a control signal WP so that record power may be made into a value only with the small predetermined minute value alpha (processing 416), is in the condition and starts actuation of the sample hold signal generator 15 (processing 417). Thereby, to the sampling timing near [which was then judged] a changing point, a sample / hold circuit 12 samples the signal light-receiving signal Pa, and outputs it as a sample hold value SH.
[0131] A control section 17 reads the sample hold value SHd changed by the analog-to-digital converter 18 (processing 418), and investigates whether the defective detecting signal DD is then outputted (decision 419). When the result of decision 419 is set to YES, since it obtains from the field which the medium defect has produced, the sample hold value SHd inputted immediately before cancels the sample hold value SHd inputted just before that (processing 420), and reads return and the following sample hold value SHd into processing 418.
[0132] Moreover, since suitable data are obtained when the result of decision 419 is set to NO, when it investigates whether the sampling of the data of a predetermined number was completed (decision 421) and the result of decision 421 is set to NO, return and the following sample hold value SHd are read into processing 418.
[0133] When the result of decision 421 is set to YES, the average value of the value of the sample hold value SHd of the predetermined number then read and obtained is computed, the result is made into the pit level **** at the time of real record power (P1) (processing 422), based on the formula (V) mentioned above, a reference value M1 is computed and the computed reference value M1 is saved (processing 423).
[0134] And it investigates whether the reference value M1 is larger than the record condition desired value M0 (decision 424). When the value of a control signal WP is set up so that record power may be made into a value only with the large minute value alpha, when the result of decision 424 is set to YES (processing 425), and the result of decision 424 is set to NO, the value of a control signal WP is set up so that record power may be made into a value only with the small predetermined minute value alpha (processing 426). Thus, if it adjusts so that record power may be in the optimal record condition, return and record power of the following cycle will be controlled by processing 425,426 to processing 417. And actuation to processing 417 - processing 426 is repeatedly performed during data-logging actuation.

[0135] Thus, since it tries, writes and carries out in a test field before data logging, the optimal record power P0 is obtained and the inside of data logging is controlling the real record power P1 by this example to be in the same record condition as the optimal record power P0, even when the dependability of the recorded data improves and prolonged continuation record actuation is performed, the stable record quality is acquired.
[0136] Moreover, since the data used in order to compute the record condition desired value M0 remove the data obtained from the defective field of a write once optical disk 2, they can control the effect of a medium defect, consequently can perform more reliable record power control.
[0137] Moreover, since the sampling timing of the data used in order to compute the record condition desired value M0 is determined according to the write once optical disk 2 then used, more suitable data can be obtained and the dependability of data logging improves.
[0138] Drawing 14 shows the important section of the write once optical disk equipment concerning the example of further others of this invention. In addition, in this drawing, the same sign is given to the same part as drawing 1 , and the corresponding part.
[0139] In this drawing, optical pickup equipment 1 is for reproducing data from a write once optical disk 2, while recording data on a write once optical disk 2, and the photo detector 6 for signal detection for

detecting the photo detector 5 for output monitors for detecting the output level of the semiconductor laser component 4 used as the light source and the semiconductor laser component 4 and the reflected light from a write once optical disk 2 is formed in the optical head 3. In addition, the tracking control means (illustration abbreviation) for making the laser beam of the focusing control means (illustration abbreviation) for uniting a focus with a recording track for the laser beam of the optical head 3 or an optical head follow a recording track etc. is attached to optical pickup equipment 1. Moreover, the seeking device (illustration abbreviation) which carries out both-way migration of the optical head 3 radial [of a write once optical disk 2] is also prepared in optical pickup equipment 1.

[0140] After the monitor light-receiving signal Pm outputted from the photo detector 5 for output monitors is changed into a voltage signal through a current / electrical-potential-difference conversion amplifier 8, it is added to the playback power control section 9 and the record power control section 10.

[0141] It is outputted to next step equipment as a regenerative signal RF while it is added to the adjustable gain amplifier 28 and the asymmetry judging circuit 13, after the signal light-receiving signal Pa outputted from the photo detector 6 for signal detection is changed into a voltage signal through a current / electrical-potential-difference conversion amplifier 11. The gain is controlled by the gain control signal GS by which the adjustable gain amplifier 28 is added from a control section 17, and the output signal is applied to the sample / hold circuit 12 as a regenerative signal RFa.

[0142] The record data DE which are added from a well-known record data generating means (illustration abbreviation) and by which the EFM (Eight to Fourteen Modulation) modulation was carried out are added to the sample hold signal generator 15 and the delay circuit 16.

[0143] The sample hold signal generator 15 is a mode according to mode signal MS added from a control section 17, the sampling signal SP is outputted to the timing which has gone through the predetermined sampling time from the standup timing of the record data DE, and the sampling signal SP is added to the sample / hold circuit 12.

[0144] Thereby, a sample / hold circuit 12 samples the regenerative signal RFa added to the timing (for example, rising edge of the sampling signal SP) to which the sampling signal SP is added, and outputs it to an analog-to-digital converter 18 by making the sampling result into the sample hold value SH.

[0145] An analog-to-digital converter 18 changes the sample hold value SH applied into a corresponding digital signal, and the output signal is applied to the control section 17 as a sample hold value SHd.

[0146] A delay circuit 16 delays the record data DE added predetermined delay time, and the output signal is applied to the control section 17 and LD (semiconductor laser component) drive circuit 20 as record data DEd.

[0147] A control section 17 controls actuation of this write once optical disk equipment, forms the control signal RP for specifying the output at the time of playback of the semiconductor laser component 4, and the control signal WP which specifies the output at the time of record of the semiconductor laser component 4, and outputs these control signals RP and a control signal WP to a digital to analog converter 21 and a digital to analog converter 22, respectively.

[0148] A digital to analog converter 21 changes the control signal RP added into a corresponding analog signal, and the output signal is applied to the playback power control section 9 as a control signal RPa.

[0149] A digital to analog converter 22 changes the control signal WP added into a corresponding analog signal, and the output signal is applied to the record power control section 10 as a control signal WPa.

[0150] The playback power control section 9 outputs the playback power signal SSr which specifies the output at the time of playback of the semiconductor laser component 4 to the LD mechanical component 20 so that the magnitude of the monitor light-receiving signal Pm may be in agreement with the magnitude of a control signal RPa.

[0151] The record power control section 10 outputs the record power signal SSw which specifies the output at the time of record of the semiconductor laser component 4 to the LD mechanical component 20 so that the magnitude of the monitor light-receiving signal Pm may be in agreement with the magnitude of a control signal WPa.

[0152] In the condition that the record data DEd are a mark state (logic H level), the LD mechanical component 20 drives the semiconductor laser component 4 with the output specified by the playback power signal SSr by the condition that the record data DEd are a non-mark state (logic L level) while driving the semiconductor laser component 4 with the output specified by the record power signal SSw. That is, the LD mechanical component 20 switches the output of the semiconductor laser component 4 to a high speed at the record power corresponding to the record power signal SSw, and the playback power corresponding to the playback power signal SSr based on the record data DEd.
[0153] Thereby, according to the record data DE, the output of the semiconductor laser component 4 changes to record power and playback power, consequently data are recorded on the recording track of a write once optical disk 2.
[0154] Moreover, it computes asymmetry by the asymmetry judging circuit 13 detecting the amplitude value by the side of plus, and the amplitude value by the side of minus from the zero level of the regenerative signal RF added, and calculating the formula (I) mentioned above based on those amplitude value, and the calculation result is added to the control section 17 as an asymmetry signal ST.
[0155] Moreover, a control section 17 exchanges data various between the external devices (for example, personal computer equipment etc.) using this write once optical disk equipment as external storage while it exchanges other elements of this write once optical disk equipment, and various data and supervises and controls actuation of those elements.
[0156] With the above configuration, when carrying out data logging of the control section 17, it performs actuation shown in drawing 15 and drawing 16 .
[0157] First, seeking to the predetermined test field beforehand set as the write once optical disk 2, changing a control signal WP to a multistage story, and carrying out sequential change of the record power of the semiconductor laser component 4, it is made to generate from the record data generating means (illustration abbreviation) of common knowledge of the record data DE of a predetermined test data, and data write-in actuation of the predetermined amount of data is performed about each record power (processing 501).
[0158] Subsequently, the asymmetry signal ST which carried out sequential playback and inputted the test data recorded by each record power from the asymmetry judging circuit 13 at the time of the playback is saved, and the asymmetry signal ST for every record power is acquired (processing 502).
[0159] And the value of the asymmetry signal ST judges the record power which takes the minimum value, sets the value of the record power as the optimal record power P0 (processing 503), and where the value corresponding to the optimal record power P0 is set to a control signal WP, it starts actual data-logging actuation (processing 504).
[0160] Where the mode SPa which mentioned above actuation of the sample hold signal generator 15 is specified, it starts, at the same time it starts the data-logging actuation (processing 505). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0161] A control section 17 adjusts the gain of the adjustable gain amplifier 28 so that the sample hold value SHd at that time may turn into a value of the predetermined range (processing 506). And if the sample hold value SHd changed by the analog-to-digital converter 18 is read (processing 507) and the read number turns into a predetermined number, the average value of the sample hold value SHd of the read predetermined number is computed, and the result is saved as pit level **** at the time of the optimal record power (processing 508).
[0162] Next, a timing change of the actuation of the sample hold signal generator 15 is made at the mode SPb mentioned above (processing 508). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period brought down by playback power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0163] A control section 17 adjusts the gain of the adjustable gain amplifier 28 so that the sample hold value SHd at that time may turn into a value of the predetermined range (processing 510). And if the sample hold value SHd changed by the analog-to-digital converter 18 is read (processing 511) and the read number turns into a predetermined number, the average value of the sample hold value SHd of the

read predetermined number is computed, and the result is saved as land level Vb at the time of the optimal record power (processing 512).
[0164] Thus, if the pit level **** and the land level Vb at the time of the optimal record power (P0) are obtained, based on the formula (II) mentioned above, the record condition desired value M0 is computed, and the computed record condition desired value M0 is saved (processing 513).
[0165] Next, a control section 17 sets up the value of a control signal WP so that record power may be made into a value only with the small predetermined minute value alpha (processing 514). And a timing change of the actuation of the sample hold signal generator 15 is made at Mode SPa (processing 515). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0166] Moreover, a control section 17 sets the gain required in processing 506 as the adjustable gain amplifier 28 next (processing 516). And if the sample hold value SHd changed by the analog-to-digital converter 18 is read (processing 517) and the read number turns into a predetermined number, the average value of the sample hold value SHd of the read predetermined number is computed, and the result is saved as pit level **** at the time of real record power (processing 518).
[0167] Next, a control section 17 makes a timing change of the actuation of the sample hold signal generator 15 at Mode SPb (processing 519). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period brought down by playback power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0168] Moreover, a control section 17 sets the gain required in processing 510 as the adjustable gain amplifier 28 next (processing 520). And if the sample hold value SHd changed by the analog-to-digital converter 18 is read (processing 521) and the read number turns into a predetermined number, the average value of the sample hold value SHd of the read predetermined number is computed, and the result is saved as land level Vb at the time of real record power (processing 522).
[0169] Thus, if the pit level **** and the land level Vb at the time of real record power (P1) are obtained, a reference value M1 will be computed based on the formula (III) mentioned above (processing 523).
[0170] And it investigates whether the reference value M1 is larger than the record condition desired value M0 (decision 524). When the value of a control signal WP is set up so that record power may be made into a value only with the large minute value alpha, when the result of decision 524 is set to YES (processing 525), and the result of decision 524 is set to NO, the value of a control signal WP is set up so that record power may be made into a value only with the small predetermined minute value alpha (processing 526). Thus, if it adjusts so that record power may be in the optimal record condition, return and record power of the following cycle will be controlled by processing 525,526 to processing 515. And actuation to processing 515 - processing 526 is repeatedly performed during data-logging actuation.

[0171] Thus, since it tries, writes and carries out in a test field before data logging, the optimal record power P0 is obtained and the inside of data logging is controlling the real record power P1 by this example to be in the same record condition as the optimal record power P0, even when the dependability of the recorded data improves and prolonged continuation record actuation is performed, the stable record quality is acquired.
[0172] Moreover, since the gain of the adjustable gain amplifier 28 is adjusted and level is adjusted to the suitable value when sampling data, suitable data can be obtained and the dependability of data logging improves.
[0173] By the way, the value of the record condition desired value M0 mentioned above may change in non-monotone, as it is indicated in drawing 18 as the case where it changes in monotone according to the magnitude of the optimal record power P0 as shown in drawing 17 . Such reduction is considered that the property of a write once optical disk 2 results.
[0174] Thus, when using the write once optical disk 2 in which the record condition desired value M0 carries out monotone change according to the magnitude of the optimal record power P0, like the example explained until now, a reference value M1 is calculated at the time of real record, and the

record power control based on the comparison result of the reference value M1 and the storage condition desired value M0 is effective.

[0175] When using the write once optical disk 2 in which the record condition desired value M0 does not carry out monotone change according to the magnitude of the optimal record power P0 to it, and a reference value M1 is calculated at the time of real record and record power control based on the comparison result of the reference value M1 and the storage condition desired value M0 is performed like the example explained until now, there is a possibility that record power may not be controlled by the suitable value.

[0176] An example of the record processing in this case is shown in drawing 19 , drawing 20 , and drawing 21 . In addition, this record processing is processing which the control section 17 of the equipment shown in drawing 1 performs.

[0177] First, actuation of the sample hold signal generator 15 is started where Mode SPa is specified (processing 601). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.

[0178] Next, a control section 17 chooses the record power which is not recording the test data, and sets the value of a control signal WP as the value corresponding to the record power (processing 602). It is made to generate from the record data generating means (illustration abbreviation) of common knowledge of the record data DE of a predetermined test data. If the test data is recorded on a predetermined test field (processing 603), the sample hold value SHd changed by the analog-to-digital converter 18 at that time is read (processing 604) and the read number turns into a predetermined number The average value of the sample hold value SHd of the read predetermined number is computed, and the result is saved as pit level **** in the record power (processing 605).

[0179] And when it investigates whether the processing about all record power was completed (decision 606) and the result of decision 606 is set to NO, actuation same about return and the following record power is carried out to processing 602.

[0180] When the result of decision 606 is set to YES, it investigates whether the value of the pit level **** is arranged in order of the magnitude of record power, and the pit level **** is carrying out the increment in monotone (processing 607, decision 608). Here, it is the same semantics that the pit level **** shows monotonicity as the record condition desired value M0 shows monotonicity.

[0181] When the result of decision 608 is set to NO, the asymmetry signal ST which carried out sequential playback and inputted the test data recorded on the test field by each record power from the asymmetry judging circuit 13 at the time of the playback is saved, and the asymmetry signal ST for every record power is acquired (processing 609).

[0182] And the value of the asymmetry signal ST judges the record power which takes the minimum value, sets the value of the record power as the optimal record power P0 (processing 610), and where the value corresponding to the optimal record power P0 is set to a control signal WP, it starts actual data-logging actuation (processing 611). And record power is fixed to the optimal record power P0 during record actuation (processing 612).

[0183] Moreover, when the result of decision 608 is set to YES, the asymmetry signal ST which carried out sequential playback and inputted the test data recorded on the test field by each record power from the asymmetry judging circuit 13 at the time of the playback is saved, and the asymmetry signal ST for every record power is acquired (processing 613).

[0184] And the value of the asymmetry signal ST judges the record power which takes the minimum value, sets the value of the record power as the optimal record power P0 (processing 614), and where the value corresponding to the optimal record power P0 is set to a control signal WP, it starts actual data-logging actuation (processing 615).

[0185] Where the mode SPa which mentioned above actuation of the sample hold signal generator 15 is specified, it starts, at the same time it starts the data-logging actuation (processing 105). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.

[0186] If the sample hold value SHd changed by the analog-to-digital converter 18 is read (processing 617) and the read number turns into a predetermined number, a control section 17 computes the average value of the sample hold value SHd of the read predetermined number, and saves the result as pit level **** at the time of the optimal record power (processing 618).
[0187] Next, a control section 17 makes a timing change of the actuation of the sample hold signal generator 15 at the mode SPb mentioned above (processing 619). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period brought down by playback power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0188] If the sample hold value SHd changed by the analog-to-digital converter 18 is read (processing 620) and the read number turns into a predetermined number, a control section 17 computes the average value of the sample hold value SHd of the read predetermined number, and saves the result as land level Vb at the time of the optimal record power (processing 621).
[0189] Thus, if the pit level **** and the land level Vb at the time of the optimal record power (P0) are obtained, based on the formula (II) mentioned above, the record condition desired value M0 is computed, and the computed record condition desired value M0 is saved (processing 622).
[0190] Next, a control section 17 sets up the value of a control signal WP so that record power may be made into a value only with the small predetermined minute value alpha (processing 623). And a timing change of the actuation of the sample hold signal generator 15 is made at Mode SPa (processing 624). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0191] If the sample hold value SHd changed by the analog-to-digital converter 18 is read (processing 625) and the read number turns into a predetermined number, a control section 17 computes the average value of the sample hold value SHd of the read predetermined number, and saves the result as pit level **** at the time of real record power (processing 626).
[0192] Next, a control section 17 makes a timing change of the actuation of the sample hold signal generator 15 at Mode SPb (processing 627). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period brought down by playback power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0193] If the sample hold value SHd changed by the analog-to-digital converter 18 is read (processing 628) and the read number turns into a predetermined number, a control section 17 computes the average value of the sample hold value SHd of the read predetermined number, and saves the result as land level Vb at the time of real record power (processing 629).
[0194] Thus, if the pit level **** and the land level Vb at the time of real record power (P1) are obtained, a reference value M1 will be computed based on the formula (III) mentioned above (processing 630).
[0195] And it investigates whether the reference value M1 is larger than the record condition desired value M0 (decision 631). When the value of a control signal WP is set up so that record power may be made into a value only with the large minute value alpha, when the result of decision 631 is set to YES (processing 632), and the result of decision 631 is set to NO, the value of a control signal WP is set up so that record power may be made into a value only with the small predetermined minute value alpha (processing 632). Thus, if it adjusts so that record power may be in the optimal record condition, return and record power of the following cycle will be controlled by processing 631,632 to processing 624. And actuation to processing 624 - processing 633 is repeatedly performed during data-logging actuation.

[0196] Thus, in this example, since the optimal record power P0 is held when the record condition desired value M0 does not carry out monotone change according to record power, suitable record power control can be performed according to the property of a write once optical disk 2.
[0197] Drawing 22 and drawing 23 show the example of further others of data-logging processing. In addition, the control section 17 of the equipment of drawing 1 performs this data-logging processing.
[0198] First, seeking to the predetermined test field beforehand set as the write once optical disk 2, changing a control signal WP to a multistage story, and carrying out sequential change of the record

power of the semiconductor laser component 4, it is made to generate from the record data generating means (illustration abbreviation) of common knowledge of the record data DE of a predetermined test data, and data write-in actuation of the predetermined amount of data is performed about each record power (processing 701).

[0199] Subsequently, the asymmetry signal ST which carried out sequential playback and inputted the test data recorded by each record power from the asymmetry judging circuit 13 at the time of the playback is saved, and the asymmetry signal ST for every record power is acquired (processing 702).

[0200] And the value of the asymmetry signal ST judges the record power which takes the minimum value, sets the value of the record power as the optimal record power P0 (processing 703), and where the value corresponding to the optimal record power P0 is set to a control signal WP, it starts actual data-logging actuation (processing 704).

[0201] Where the mode SPa which mentioned above actuation of the sample hold signal generator 15 is specified, it starts, at the same time it starts the data-logging actuation (processing 705). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.

[0202] A control section 17 reads the sample hold value SHd changed by the analog-to-digital converter 18 until it starts 1 rotation timer TM 1 with which the time amount equivalent to one rotation of a write once optical disk 2 is set (processing 706) and this timer TM 1 carries out a time-out (processing 707, NO loop formation of decision 708). If the result of decision 708 is set to YES, the average value of the value of the sample hold value SHd then read is computed, and the result is saved as pit level **** at the time of the optimal record power (processing 709).

[0203] Thus, if the pit level **** at the time of the optimal record power (P0) is obtained, based on the formula (IV) mentioned above, the record condition desired value M0 is computed, and the computed record condition desired value M0 is saved (processing 710).

[0204] Next, a control section 17 sets up the value of a control signal WP so that record power may be made into a value only with the small predetermined minute value alpha (processing 711), and where the mode SPa which is in the condition and mentioned above actuation of the sample hold signal generator 15 is specified, it starts it (processing 712). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.

[0205] A control section 17 reads the sample hold value SHd changed by the analog-to-digital converter 18 until it starts 1 rotation timer TM 1 with which the time amount equivalent to one rotation of a write once optical disk 2 is set (processing 713) and this timer TM 1 carries out a time-out (processing 714, NO loop formation of decision 715). If the result of decision 715 is set to YES, the average value of the value of the sample hold value SHd then read is computed, and the result is saved as pit level **** at the time of real record power (processing 716).

[0206] Thus, if the pit level **** at the time of real record power (P1) is obtained, based on the formula (V) mentioned above, a reference value M1 is computed and the computed reference value M1 is saved (processing 717).

[0207] And it investigates whether the reference value M1 is larger than the record condition desired value M0 (decision 718). When the value of a control signal WP is set up so that record power P1 may be made into a value only with the large minute value alpha, when the result of decision 718 is set to YES (processing 718), and the result of decision 718 is set to NO, the value of a control signal WP is set up so that record power P1 may be made into a value only with the small predetermined minute value alpha (processing 720).

[0208] Thus, if processing 719,720 adjusts so that the record power P1 may be in the optimal record condition, it will investigate whether the value of the record power P1 after adjustment is larger than the value which applied the predetermined value beta (>alpha) to the optimal record power P0 (decision 721). Since the value after adjustment is an excessive value when the result of decision 721 is set to YES, the value of the record power P1 is set as the value which applied the predetermined value beta to the optimal record power P0 (processing 722), and return and record power of the following cycle are

controlled to processing 712.
[0209] Moreover, when the result of decision 721 is set to NO, it investigates whether the value of the record power P1 after adjustment is smaller than the value which subtracted the predetermined value beta from the optimal record power P0 (decision 723). Since the value after adjustment is too little value when the result of decision 723 is set to YES, the value of the record power P1 is set as the value which subtracted the predetermined value beta from the optimal record power P0 (processing 724), and return and record power of the following cycle are controlled to processing 712.
[0210] Moreover, since the value of the record power P1 after adjustment is the case where it is contained in the suitable range (P0**beta) when the result of decision 723 is set to NO, return and record power of the following cycle are controlled by the condition as it is to processing 712. And actuation to processing 712 - processing 724 is repeatedly performed during data-logging actuation.
[0211] Thus, in this example, since the magnitude of the record power P1 is restricted to the predetermined range (P0**beta), the defect of a circuit etc. becomes a cause and the situation to which record actuation is carried out by extremely unusual power can be avoided.
[0212] By the way, if data-logging actuation is performed to the write once optical disk 2, since temperature will rise according to the time amount of the record actuation, when the optimal record power P0 is determined, it is desirable [the value beta which specifies the setting range of the record power P1 mentioned above] to set up according to the temperature change to a setup of the real record power P1 from from.
[0213] The example of processing at the time of data logging in this case is shown in drawing 24 and drawing 25 .
[0214] First, seeking to the predetermined test field beforehand set as the write once optical disk 2, changing a control signal WP to a multistage story, and carrying out sequential change of the record power of the semiconductor laser component 4, it is made to generate from the record data generating means (illustration abbreviation) of common knowledge of the record data DE of a predetermined test data, and data write-in actuation of the predetermined amount of data is performed about each record power (processing 801).
[0215] Subsequently, the asymmetry signal ST which carried out sequential playback and inputted the test data recorded by each record power from the asymmetry judging circuit 13 at the time of the playback is saved, and the asymmetry signal ST for every record power is acquired (processing 802).
[0216] And the value of the asymmetry signal ST judges the record power which takes the minimum value, sets the value of the record power as the optimal record power P0 (processing 803), and where the value corresponding to the optimal record power P0 is set to a control signal WP, it starts actual data-logging actuation (processing 804).
[0217] Where the mode SPa which mentioned above actuation of the sample hold signal generator 15 is specified, it starts, at the same time it starts the data-logging actuation (processing 805). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.
[0218] A control section 17 reads the sample hold value SHd changed by the analog-to-digital converter 18 until it starts 1 rotation timer TM 1 with which the time amount equivalent to one rotation of a write once optical disk 2 is set (processing 806) and this timer TM 1 carries out a time-out (processing 807, NO loop formation of decision 808). If the result of decision 808 is set to YES, the average value of the value of the sample hold value SHd then read is computed, and the result is saved as pit level **** at the time of the optimal record power (processing 809).
[0219] Thus, if the pit level **** at the time of the optimal record power (P0) is obtained, based on the formula (IV) mentioned above, the record condition desired value M0 is computed, and the computed record condition desired value M0 is saved (processing 810). With it, the detection temperature of a temperature sensor (illustration abbreviation) established suitably is inputted, and it saves as temperature TA (processing 811).
[0220] Next, a control section 17 sets up the value of a control signal WP so that record power may be made into a value only with the small predetermined minute value alpha (processing 812), and where the

mode SPa which is in the condition and mentioned above actuation of the sample hold signal generator 15 is specified, it starts it (processing 813). Thereby, the semiconductor laser component 4 samples the signal light-receiving signal Pa outputted to the period started by record power, and outputs a sample / hold circuit 12 as a sample hold value SH.

[0221] A control section 17 reads the sample hold value SHd changed by the analog-to-digital converter 18 until it starts 1 rotation timer TM 1 with which the time amount equivalent to one rotation of a write once optical disk 2 is set (processing 814) and this timer TM 1 carries out a time-out (processing 815, NO loop formation of decision 816). If the result of decision 816 is set to YES, the average value of the value of the sample hold value SHd then read is computed, and the result is saved as pit level **** at the time of real record power (processing 817).

[0222] Thus, if the pit level **** at the time of real record power (P1) is obtained, based on the formula (V) mentioned above, a reference value M1 is computed and the computed reference value M1 is saved (processing 818). Moreover, the detection temperature of a temperature sensor is inputted, it saves as temperature TB (processing 819), and the magnitude of a value beta is determined based on the difference of temperature TA and temperature TB (processing 820). In addition, as the decision approach of this value beta, for every range of the magnitude of the difference of temperature TA and temperature TB, it can ask for the magnitude of a value beta by experiment etc. beforehand, and the approach of determining based on that experimental value can be used, for example. Moreover, the function based on an experiment can be formed and it can also determine by using the function.

[0223] And it investigates whether the reference value M1 is larger than the record condition desired value M0 (decision 821). When the value of a control signal WP is set up so that record power P1 may be made into a value only with the large minute value alpha, when the result of decision 821 is set to YES (processing 822), and the result of decision 821 is set to NO, the value of a control signal WP is set up so that record power P1 may be made into a value only with the small predetermined minute value alpha (processing 823).

[0224] Thus, if processing 822,823 adjusts so that the record power P1 may be in the optimal record condition, it will investigate whether the value of the record power P1 after adjustment is larger than the value which applied the predetermined value beta (>alpha) to the optimal record power P0 (decision 824). Since the value after adjustment is an excessive value when the result of decision 824 is set to YES, the value of the record power P1 is set as the value which applied the predetermined value beta to the optimal record power P0 (processing 825), and return and record power of the following cycle are controlled to processing 813.

[0225] Moreover, when the result of decision 824 is set to NO, it investigates whether the value of the record power P1 after adjustment is smaller than the value which subtracted the predetermined value beta from the optimal record power P0 (decision 826). Since the value after adjustment is too little value when the result of decision 826 is set to YES, the value of the record power P1 is set as the value which subtracted the predetermined value beta from the optimal record power P0 (processing 827), and return and record power of the following cycle are controlled to processing 813.

[0226] Moreover, since the value of the record power P1 after adjustment is the case where it is contained in the suitable range (P0**beta) when the result of decision 826 is set to NO, return and record power of the following cycle are controlled by the condition as it is to processing 813. And actuation to processing 813 - processing 827 is repeatedly performed during data-logging actuation.

[0227] Thus, in this example, since the value of beta is set up according to a temperature change while restricting the magnitude of the record power P1 to the predetermined range (P0**beta), the defect of a circuit etc. becomes a cause and the situation to which record actuation is carried out by extremely unusual power can be avoided.

[0228] In addition, this invention is applicable similarly about write once optical disk equipment like the so-called CD-R equipment. Moreover, although the example mentioned above explained the case where EFM was used as a data modulation technique, this invention is applicable similarly about the case where other data modulation techniques are used.

[Translation done.]

DESCRIPTION OF DRAWINGS

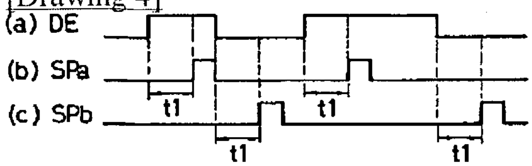
[Brief Description of the Drawings]
[Drawing 1] The block diagram showing the important section of the write once optical disk equipment concerning one example of this invention.
[Drawing 2] The flow chart which showed a part of example of data-logging processing.
[Drawing 3] The flow chart which showed other parts of an example of data-logging processing.
[Drawing 4] The wave form chart which illustrated sampling mode.
[Drawing 5] The flow chart which showed other examples of data-logging processing.
[Drawing 6] The block diagram having shown the important section of the write once optical disk equipment concerning other examples of this invention.
[Drawing 7] The flow chart which showed a part of example of further others of data-logging processing.
[Drawing 8] The flow chart which showed other parts of the example of further others of data-logging processing.
[Drawing 9] The graphical representation having shown an example of change of the reflected light reinforcement from a write once optical disk.
[Drawing 10] The wave form chart for explaining change of sampling timing.
[Drawing 11] The graphical representation for explaining the changing point of ****.
[Drawing 12] The flow chart which showed a part of data-logging processings and also other examples.
[Drawing 13] The flow chart which showed other parts of data-logging processing and also other examples.
[Drawing 14] The block diagram having shown the important section of the write once optical disk equipment concerning the example of further others of this invention.
[Drawing 15] The flow chart which showed a part of another example of data-logging processing.
[Drawing 16] The flow chart which showed other parts of another example of data-logging processing.
~~[Drawing 17] The graphical representation for explaining the monotonicity of M0.~~
[Drawing 18] The graphical representation for explaining the nonmonotonicity of M0.
[Drawing 19] The flow chart which showed a part of example of data-logging processing another again.
[Drawing 20] The flow chart which showed other parts of example another again of data-logging processing.
[Drawing 21] The flow chart which showed the remaining part of example another again of data-logging processing.
[Drawing 22] The flow chart which showed a part of still more nearly another example of data-logging processing.
[Drawing 23] The flow chart which showed other parts of still more nearly another example of data-logging processing.
[Drawing 24] The flow chart which showed a part of data-logging processing and also another example.
[Drawing 25] The flow chart which showed other parts of data-logging processing and also another example.

[Drawing 26] The wave form chart for explaining asymmetry.
[Description of Notations]
17 Control Section

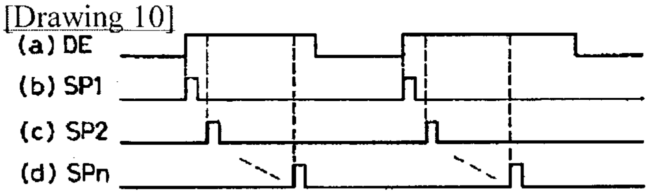
[Translation done.]

DRAWINGS

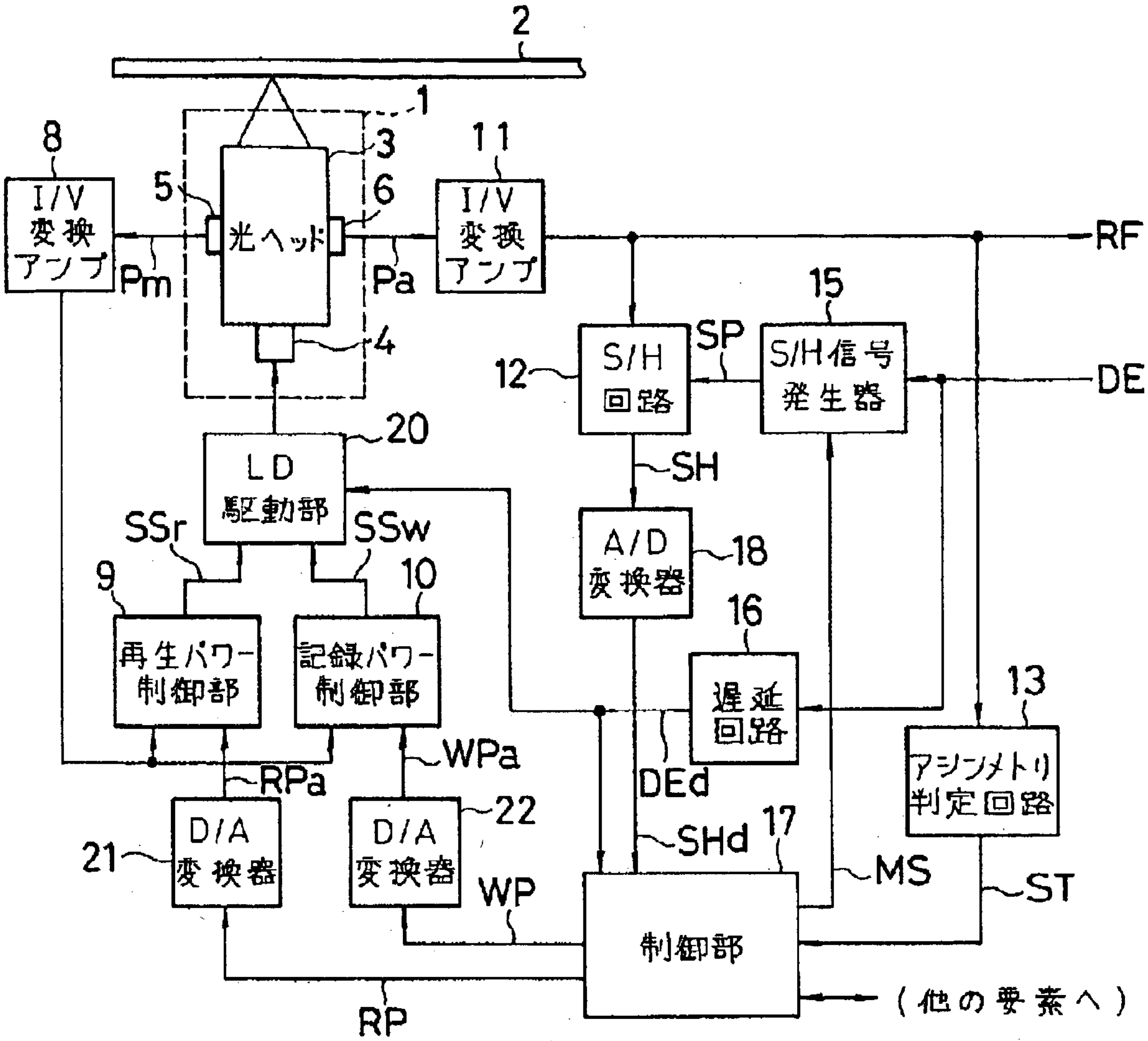
[Drawing 4]



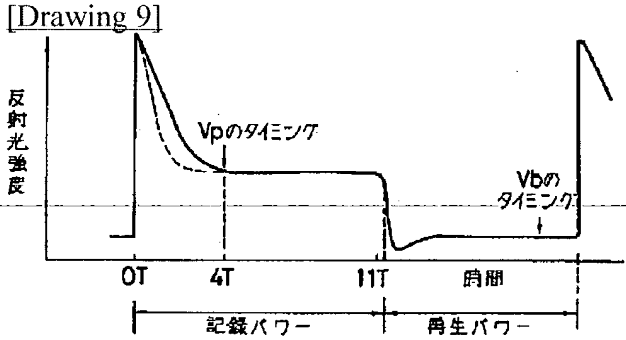
[Drawing 10]



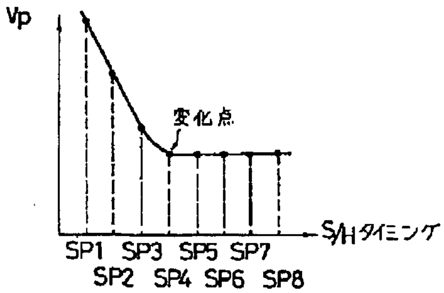
[Drawing 1]



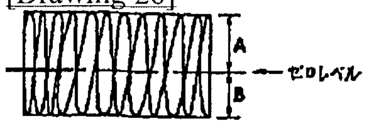
[Drawing 9]



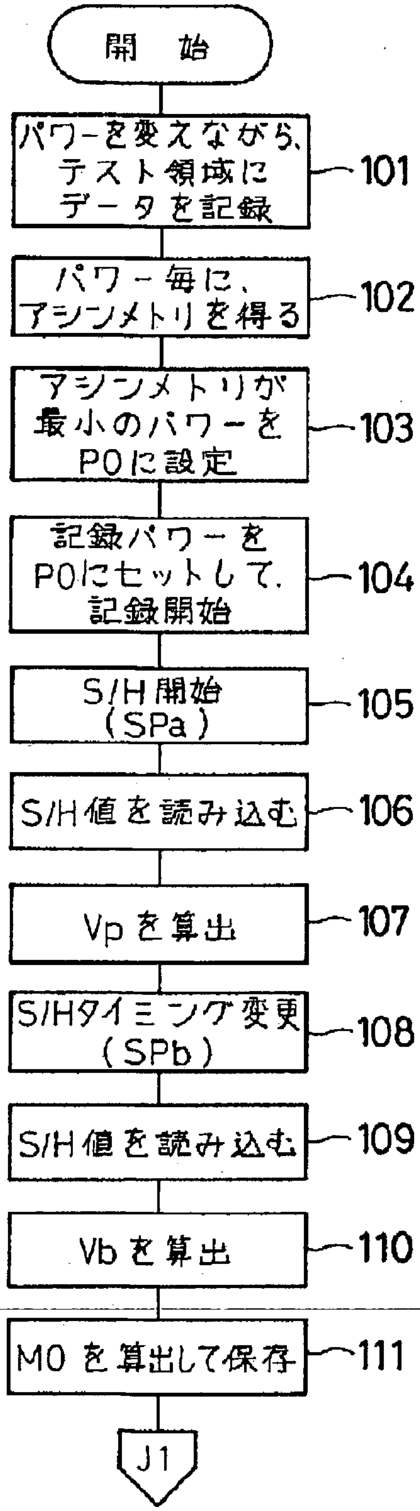
[Drawing 11]



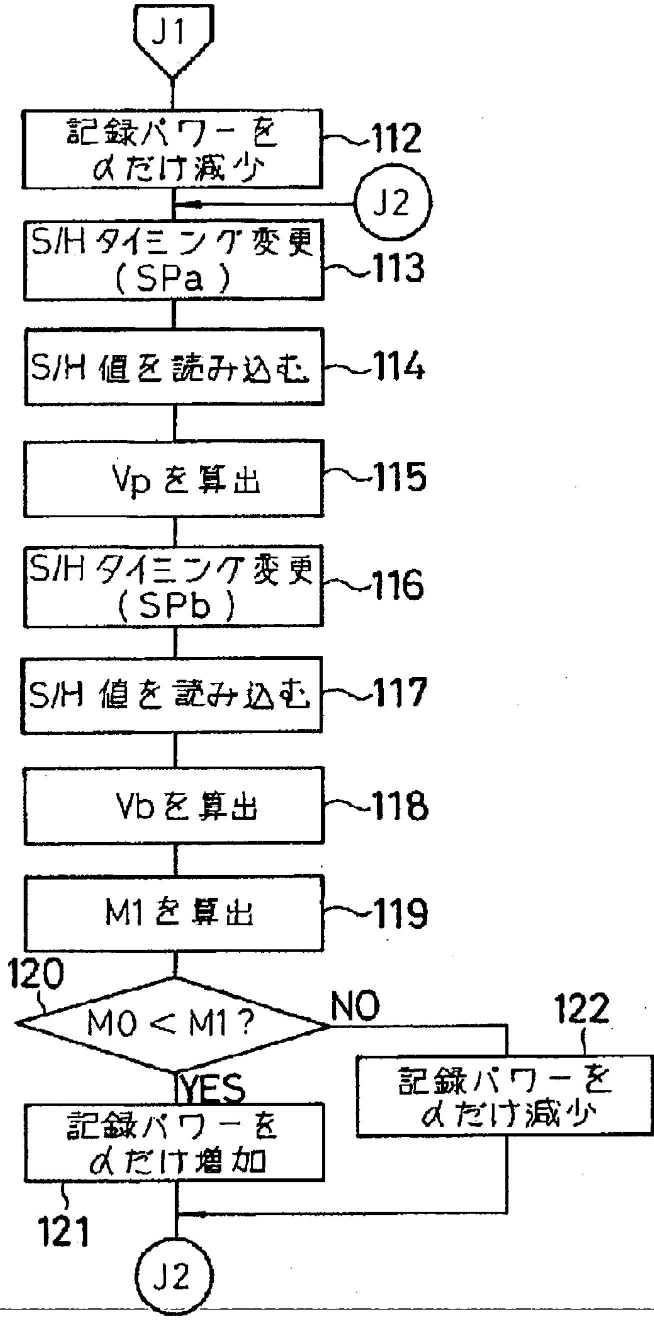
[Drawing 26]



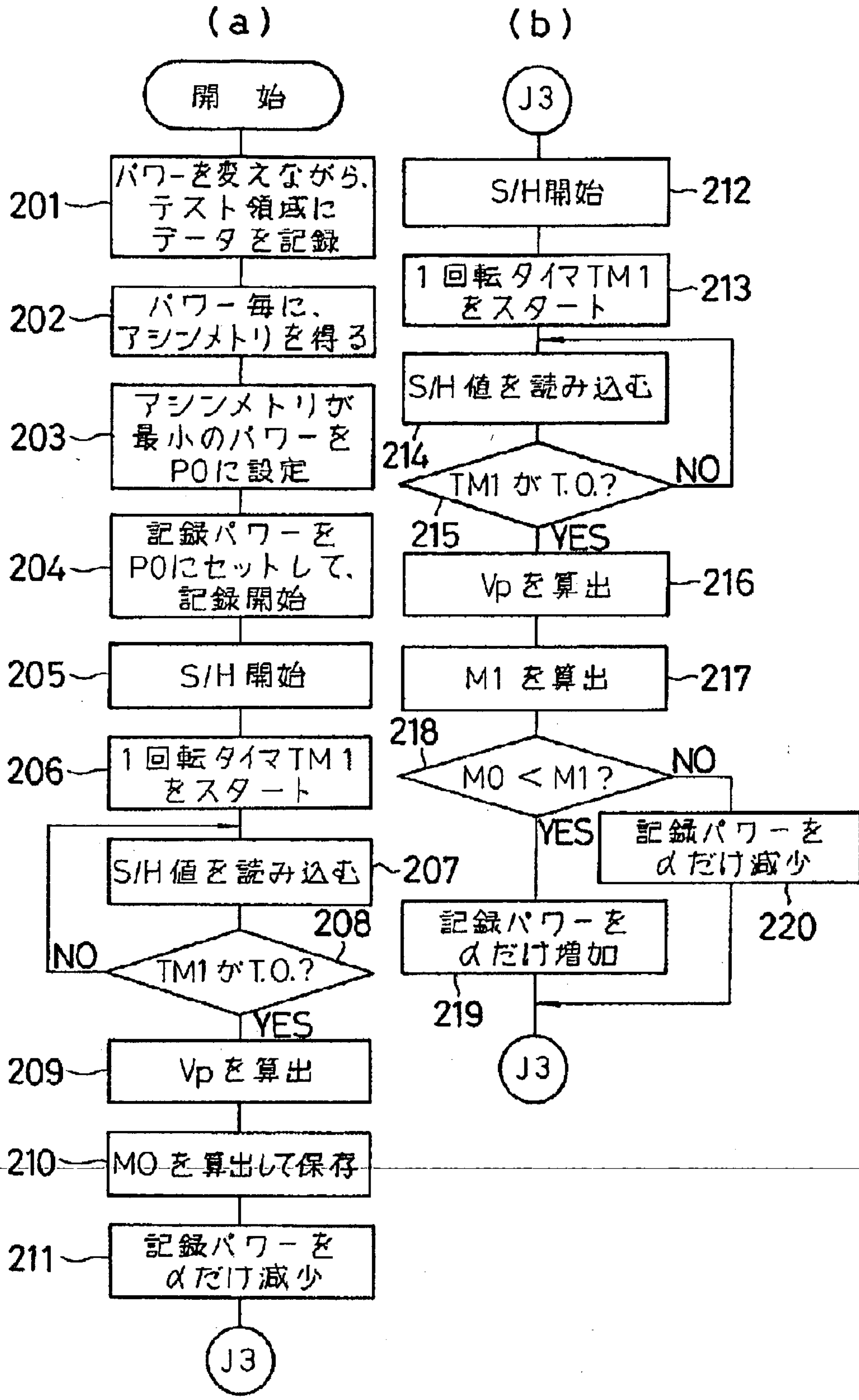
[Drawing 2]


開始
パワーを変えながら、テスト領域にデータを記録
101
パワー毎に、アシンメトリを得る
102
アシンメトリが最小のパワーをP0に設定
103
記録パワーをP0にセットして、記録開始
104
S/H開始(SPa)
105
S/H値を読み込む
106
Vpを算出
107
S/Hタイミング変更(SPb)
108
S/H値を読み込む
109
Vbを算出
110
M0を算出して保存
111
J1

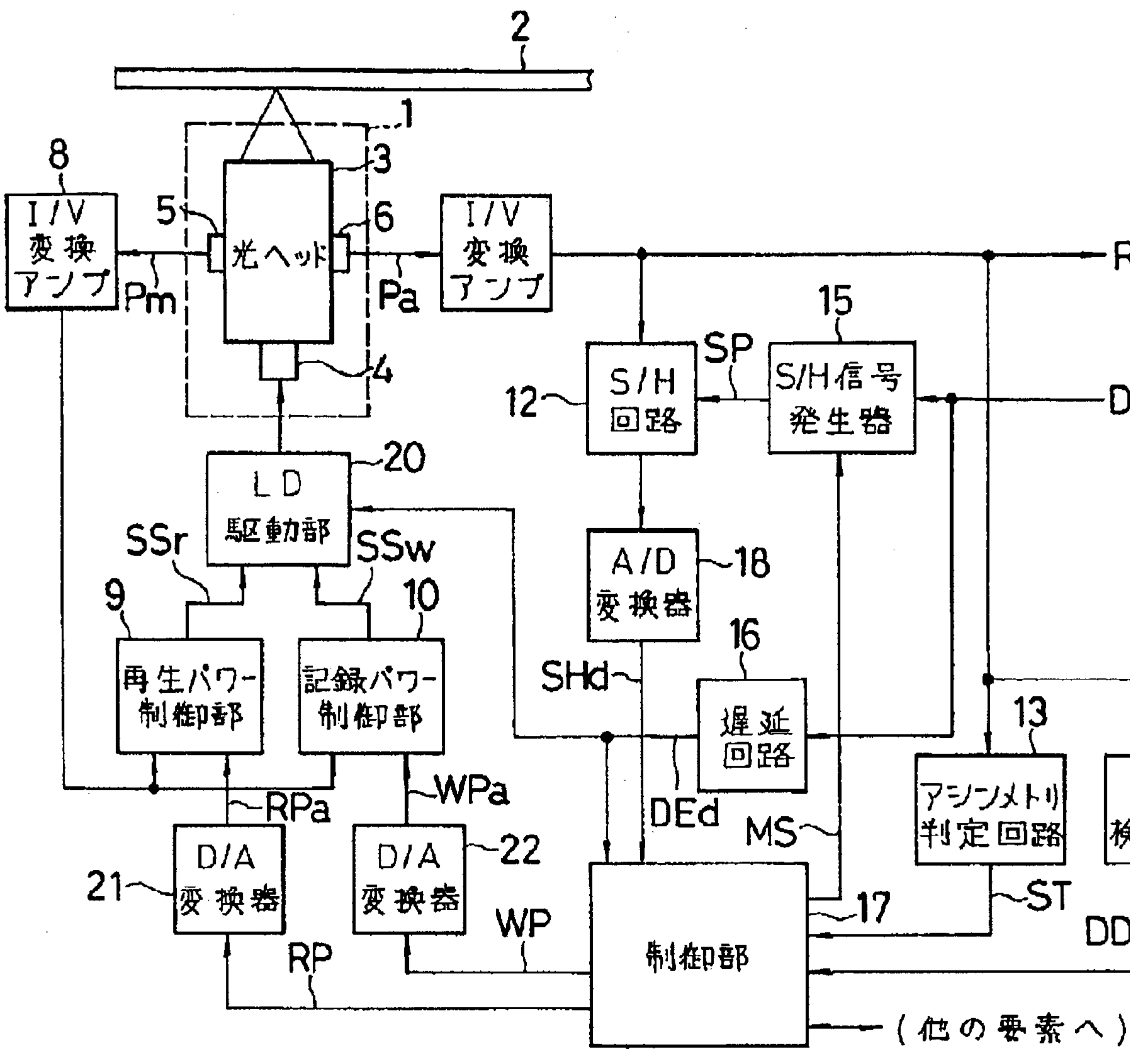
[Drawing 3]


J1
記録パワーをαだけ減少
112
J2
S/Hタイミング変更(SPa)
113
S/H値を読み込む
114
Vpを算出
115
S/Hタイミング変更(SPb)
116
S/H値を読み込む
117
Vbを算出
118
M1を算出
119
120
M0 < M1?
NO
122
記録パワーをαだけ減少
YES
記録パワーをαだけ増加
121
J2

[Drawing 5]

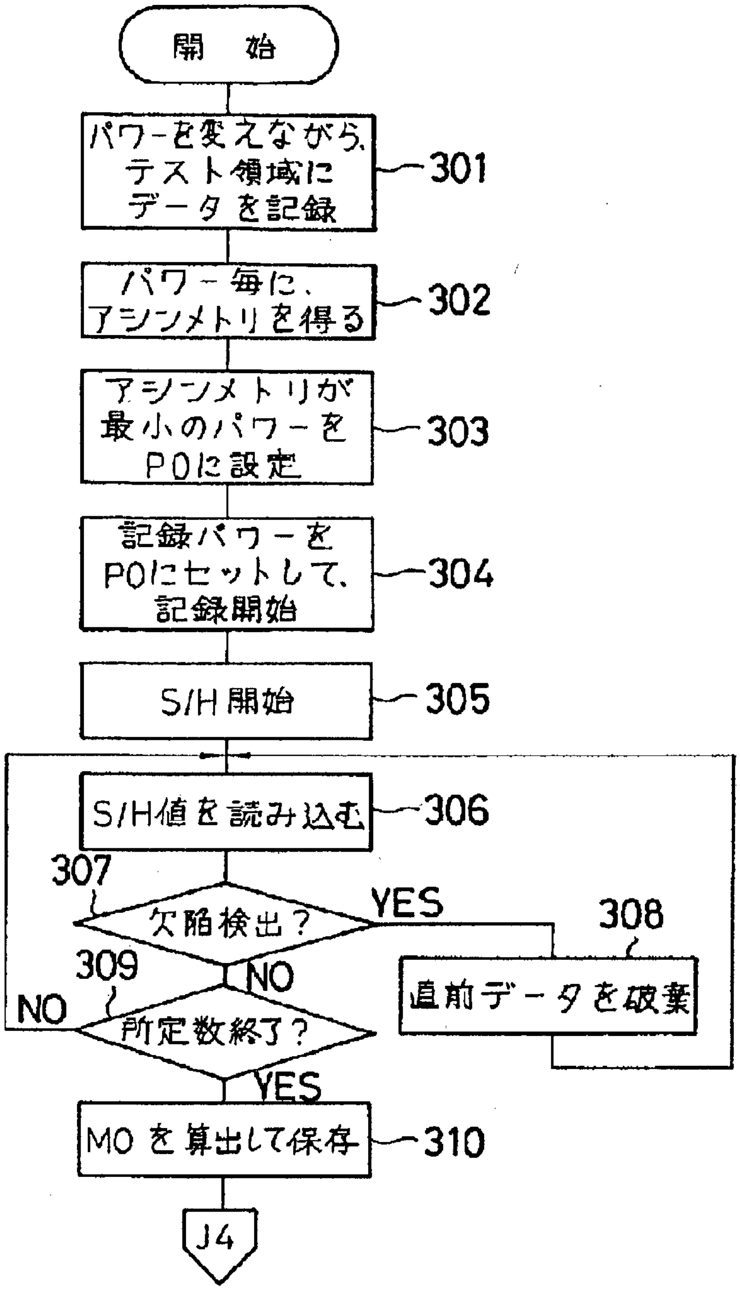

(a)
(b)
開 始
201
パワーを変えながら、テスト領域にデータを記録
202
パワー毎に、アシンメトリを得る
203
アシンメトリが最小のパワーをP0に設定
204
記録パワーをP0にセットして、記録開始
205
S/H開始
206
1回転タイマTM1をスタート
S/H値を読み込む
207
208
NO
TM1がT.O.?
YES
209
Vpを算出
210
M0を算出して保存
211
記録パワーをαだけ減少
J3
J3
S/H開始
212
1回転タイマTM1をスタート
213
S/H値を読み込む
214
TM1がT.O.?
NO
215
YES
Vpを算出
216
M1を算出
217
218
M0 < M1 ?
NO
YES
記録パワーをαだけ減少
220
記録パワーをαだけ増加
219
J3

[Drawing 6]

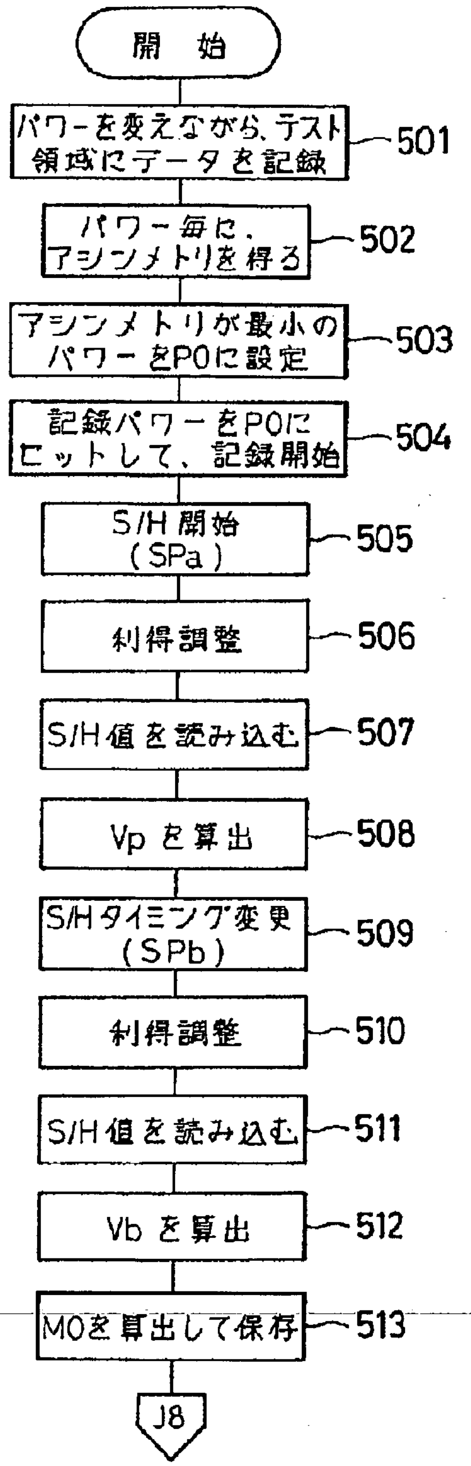


2
1
3
8
I/V
変換
アンプ
5
光ヘッド
6
I/V
変換
アンプ
RF
Pm
Pa
15
SP
S/H信号
発生器
12
S/H
回路
DE
4
20
LD
駆動部
SSr
SSw
A/D
変換器
18
9
10
再生パワー
制御部
記録パワー
制御部
SHd
16
遅延
回路
13
25
アシンメトリ
判定回路
欠陥
検出回路
RPa
WPa
DEd
MS
D/A
変換器
21
22
17
ST
DD
WP
RP
制御部
(他の要素へ)

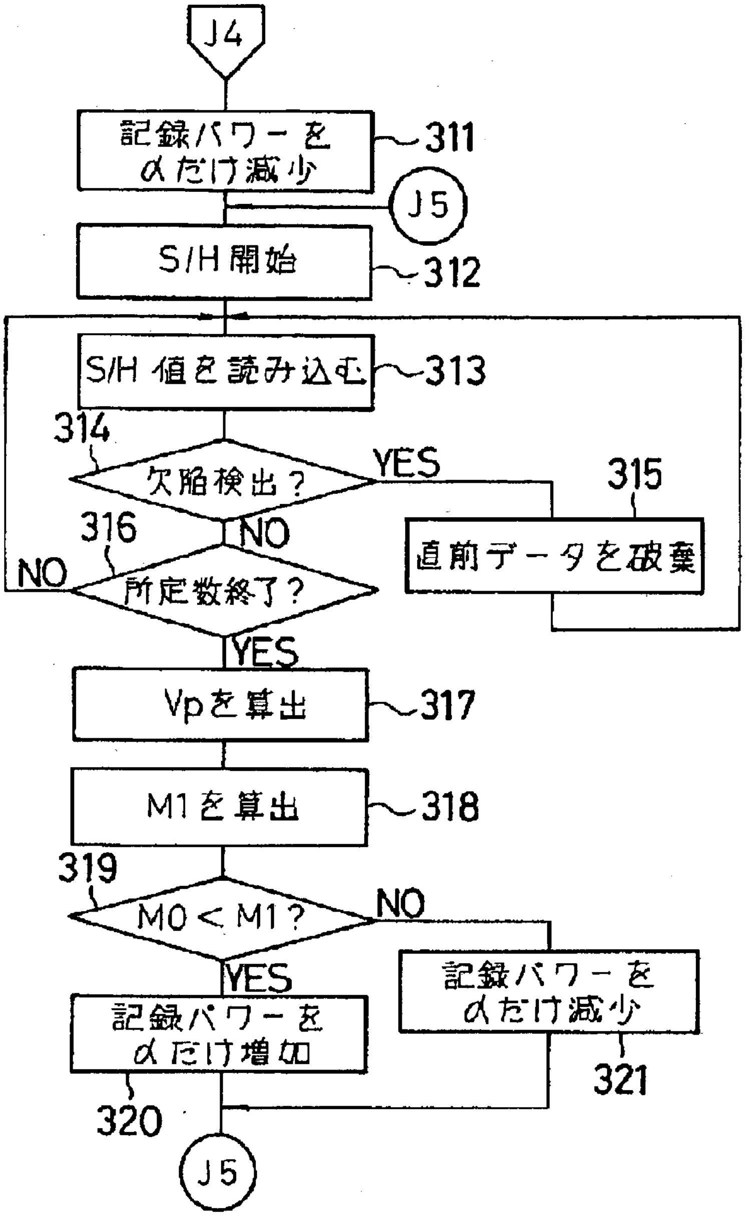
[Drawing 7]


開始
パワーを変えながら、テスト領域にデータを記録
301
パワー毎に、アシンメトリを得る
302
アシンメトリが最小のパワーをP0に設定
303
記録パワーをP0にセットして、記録開始
304
S/H開始
305
S/H値を読み込む
306
307
欠陥検出？
YES
NO
308
直前データを破棄
309
NO
所定数終了？
YES
M0を算出して保存
310
J4

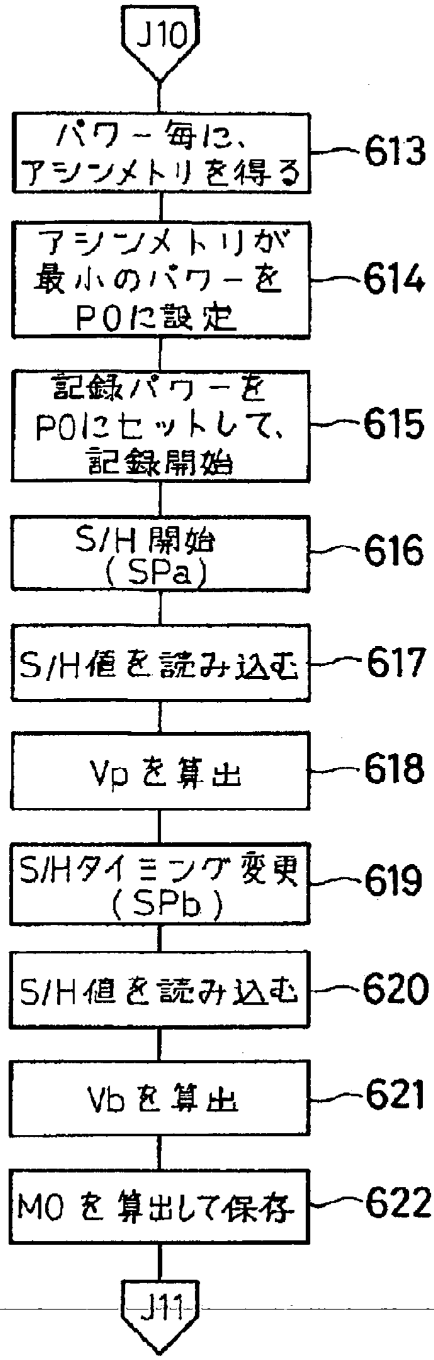
[Drawing 15]


開 始
パワーを変えながら、テスト領域にデータを記録
501
パワー毎に、アシンメトリを得る
502
アシンメトリが最小のパワーをP0に設定
503
記録パワーをP0にセットして、記録開始
504
S/H開始 (SPa)
505
利得調整
506
S/H値を読み込む
507
Vpを算出
508
S/Hタイミング変更 (SPb)
509
利得調整
510
S/H値を読み込む
511
Vbを算出
512
M0を算出して保存
513
J8

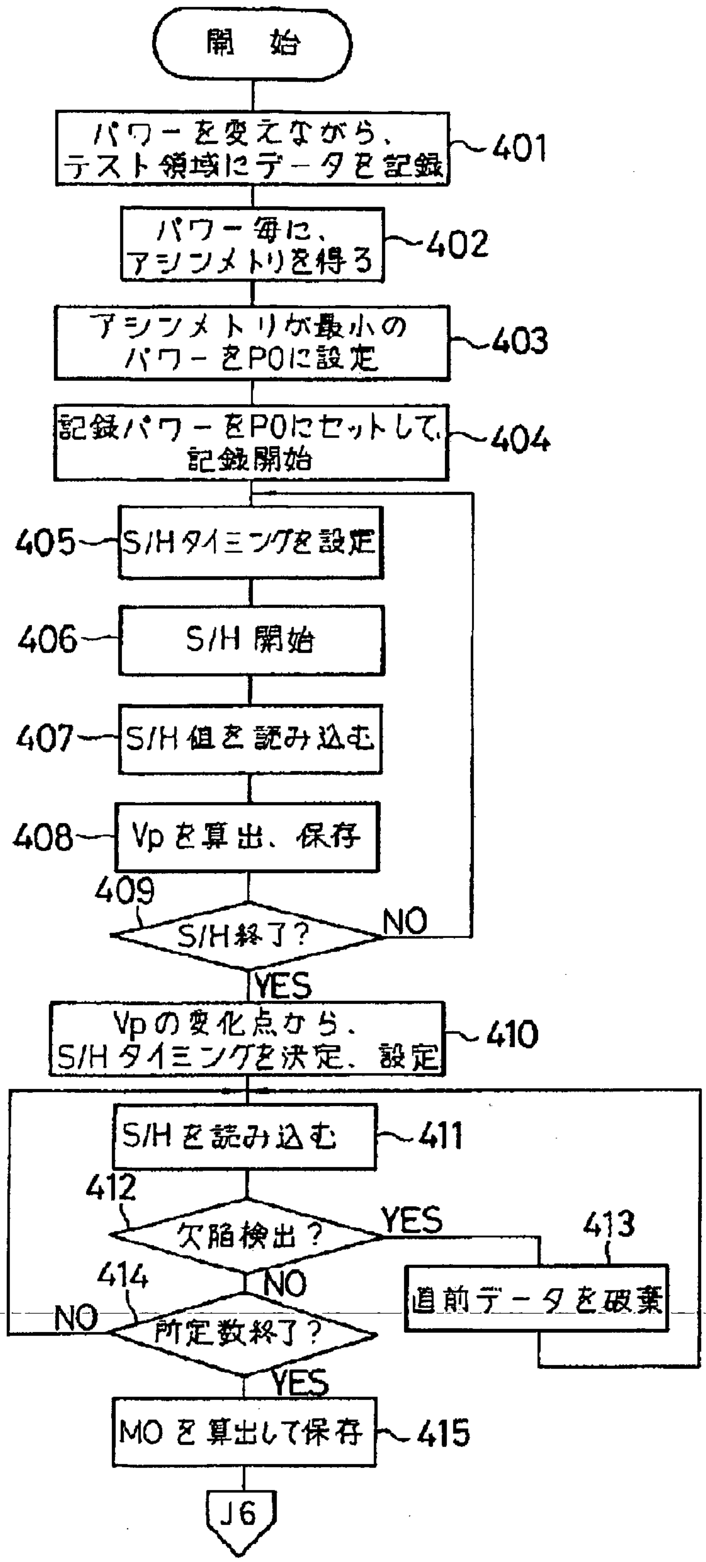
[Drawing 8]


J4
記録パワーをαだけ減少
311
J5
S/H開始
312
S/H値を読み込む
313
314
欠陥検出？
YES
315
直前データを破棄
NO
316
NO
所定数終了？
YES
Vpを算出
317
M1を算出
318
319
M0＜M1？
NO
YES
記録パワーをαだけ減少
321
記録パワーをαだけ増加
320
J5

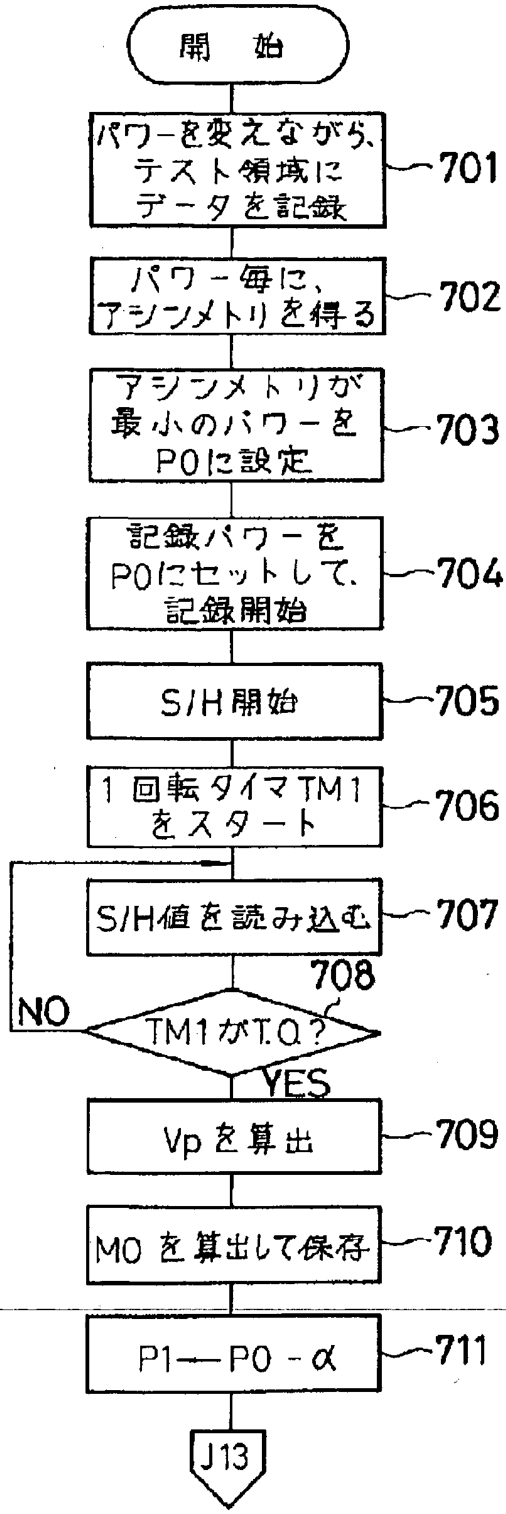
[Drawing 20]


J10
パワー毎に、アシンメトリを得る
613
アシンメトリが最小のパワーをP0に設定
614
記録パワーをP0にセットして、記録開始
615
S/H開始(SPa)
616
S/H値を読み込む
617
Vpを算出
618
S/Hタイミング変更(SPb)
619
S/H値を読み込む
620
Vbを算出
621
M0を算出して保存
622
J11

[Drawing 12]

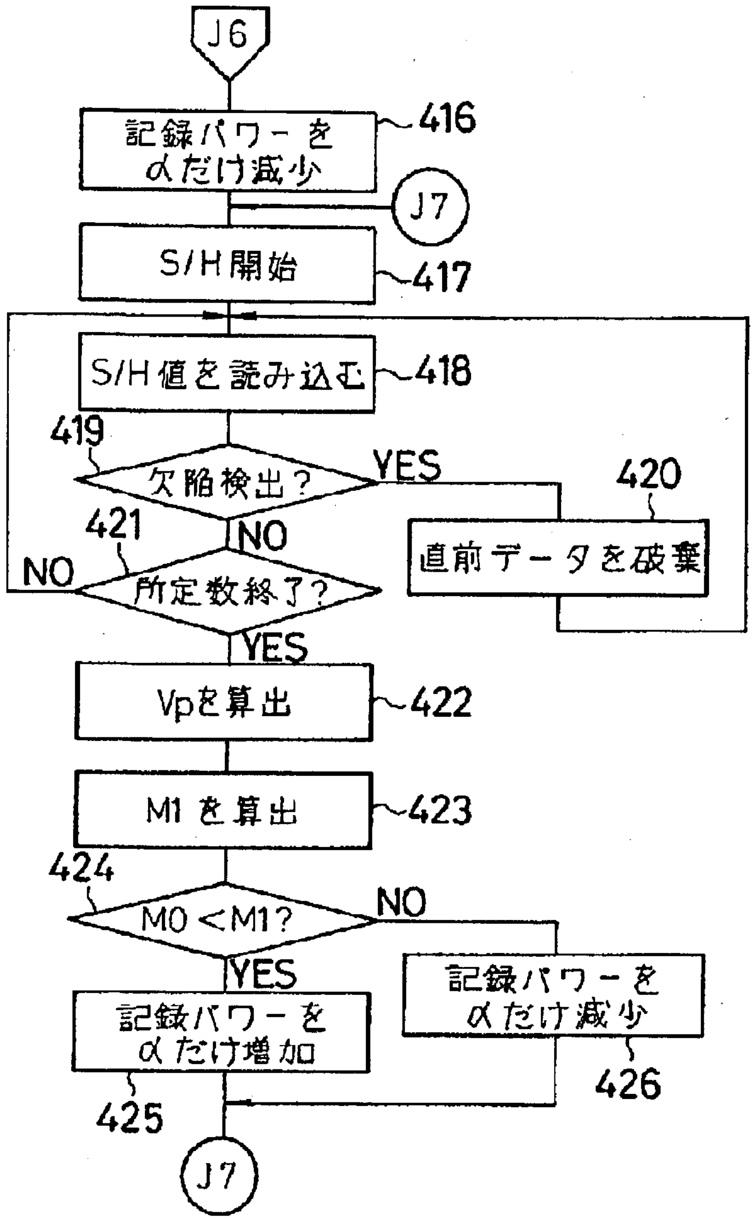

開始
パワーを変えながら、テスト領域にデータを記録
401
パワー毎に、アシンメトリを得る
402
アシンメトリが最小のパワーをP0に設定
403
記録パワーをP0にセットして、記録開始
404
405
S/Hタイミングを設定
406
S/H開始
407
S/H値を読み込む
408
Vpを算出、保存
409
S/H終了?
NO
YES
Vpの変化点から、S/Hタイミングを決定、設定
410
S/Hを読み込む
411
412
欠陥検出?
YES
413
直前データを破棄
NO
414
NO
所定数終了?
YES
MOを算出して保存
415
J6

[Drawing 22]

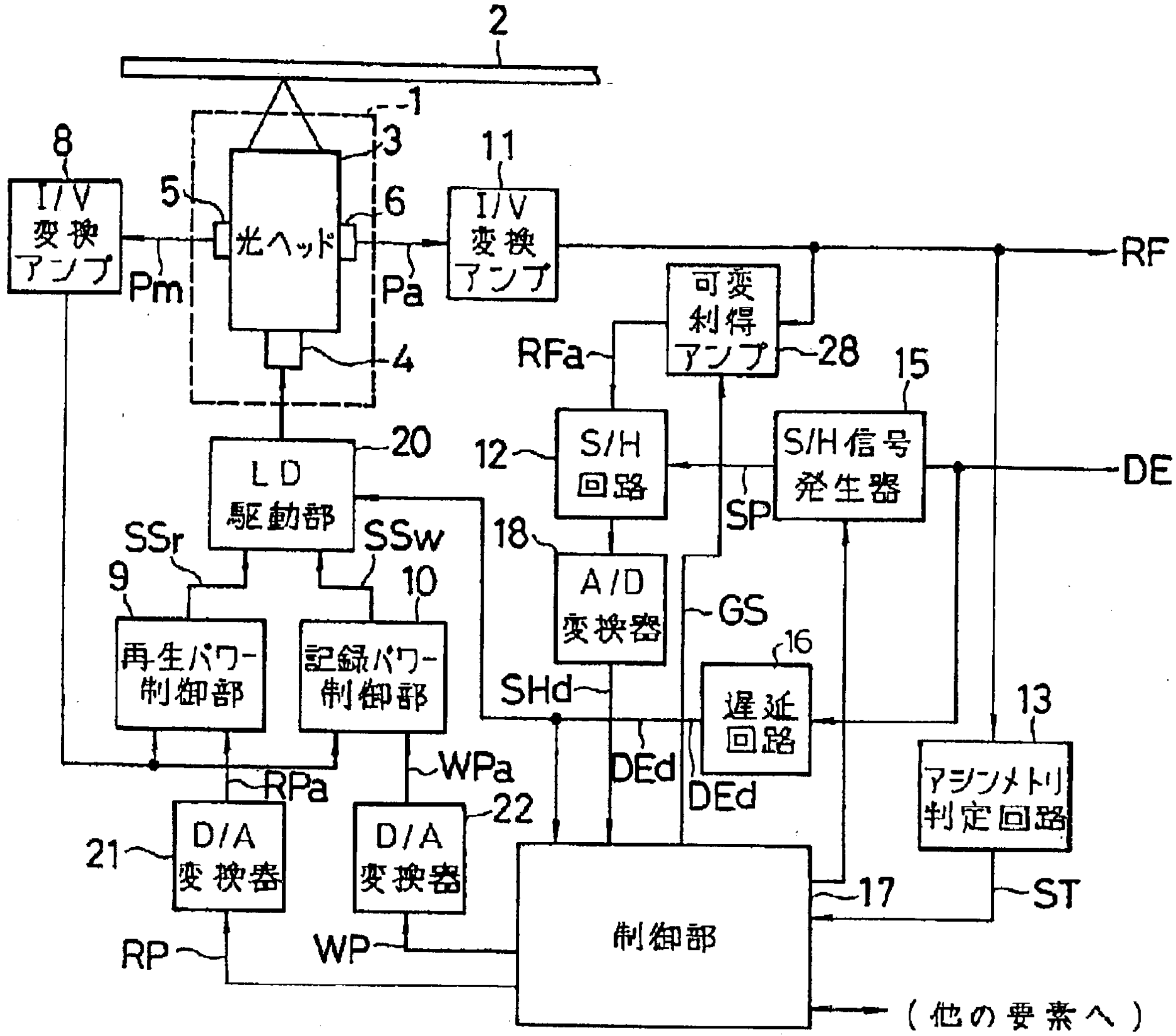


開 始
パワーを変えながら、テスト領域にデータを記録
701
パワー毎に、アシンメトリを得る
702
アシンメトリが最小のパワーをP0に設定
703
記録パワーをP0にセットして、記録開始
704
S/H開始
705
1回転タイマTM1をスタート
706
S/H値を読み込む
707
708
NO
TM1がT.O?
YES
Vpを算出
709
M0を算出して保存
710
P1←P0－α
711
J13

[Drawing 13]

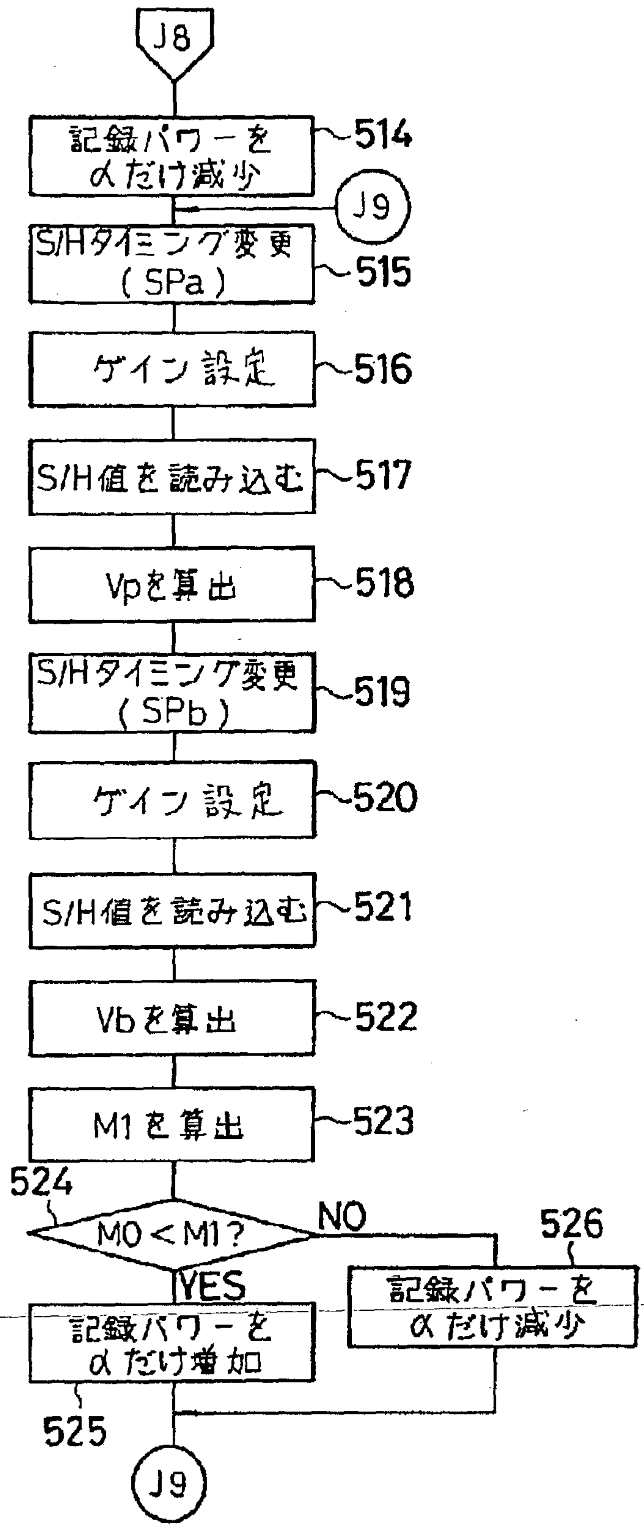

J6
記録パワーを
αだけ減少
416
J7
S/H開始
417
S/H値を読み込む
418
419
欠陥検出？
YES
420
直前データを破棄
421
NO
所定数終了？
NO
YES
Vpを算出
422
M1を算出
423
424
M0＜M1？
NO
YES
記録パワーを
αだけ増加
425
記録パワーを
αだけ減少
426
J7

[Drawing 14]

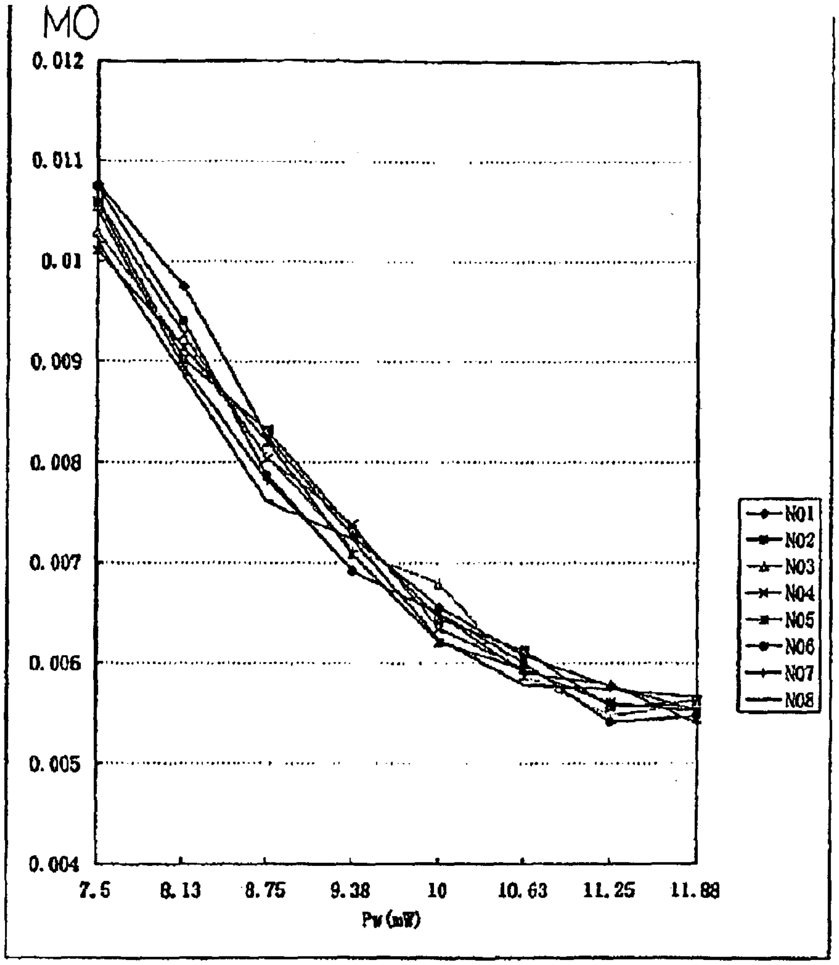


2
1
3
8
I/V
変換
アンプ
5
光ヘッド
6
11
I/V
変換
アンプ
RF
Pm
Pa
可変
利得
アンプ
28
4
RFa
15
20
LD
駆動部
12
S/H
回路
S/H信号
発生器
DE
SP
SSr
SSw
18
A/D
変換器
9
10
GS
再生パワー
制御部
記録パワー
制御部
16
SHd
遅延
回路
13
WPa
RPa
DEd
DEd
アシンメトリ
判定回路
21
D/A
変換器
D/A
変換器
22
17
ST
RP
WP
制御部
(他の要素へ)

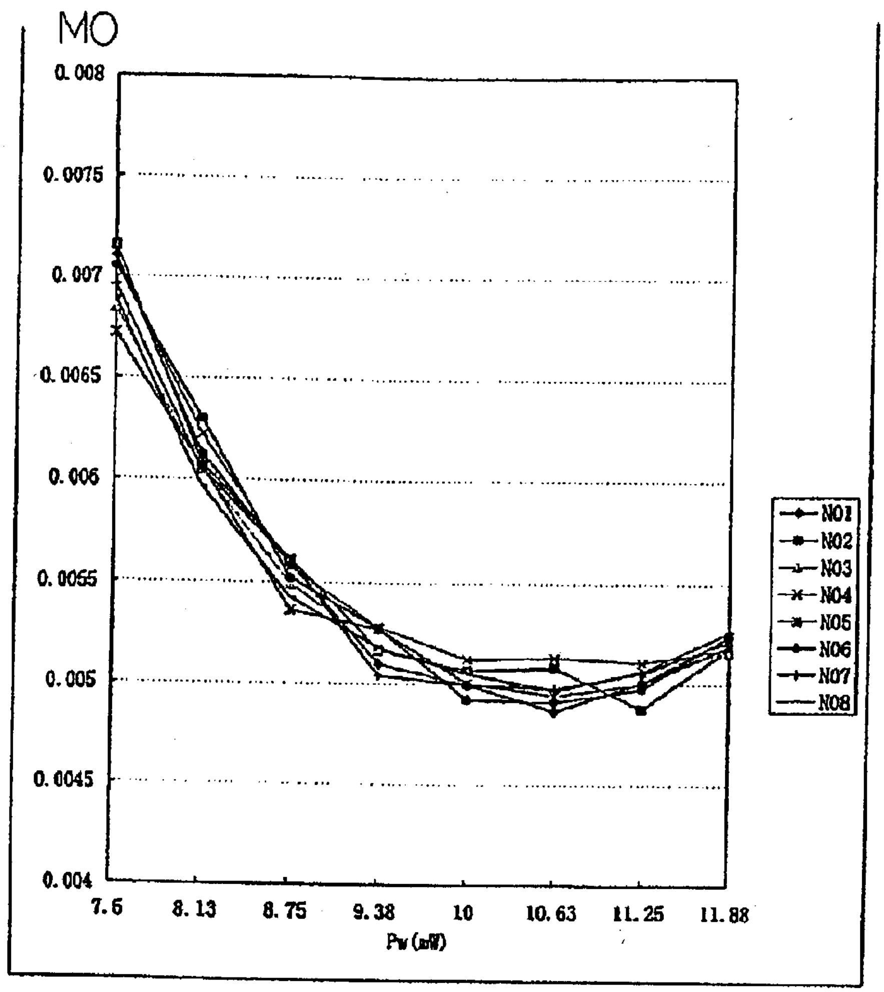
[Drawing 16]


J8
記録パワーを
αだけ減少
514
J9
S/Hタイミング変更
(SPa)
515
ゲイン設定
516
S/H値を読み込む
517
Vpを算出
518
S/Hタイミング変更
(SPb)
519
ゲイン設定
520
S/H値を読み込む
521
Vbを算出
522
M1を算出
523
524
M0＜M1?
NO
YES
526
記録パワーを
αだけ減少
記録パワーを
αだけ増加
525
J9

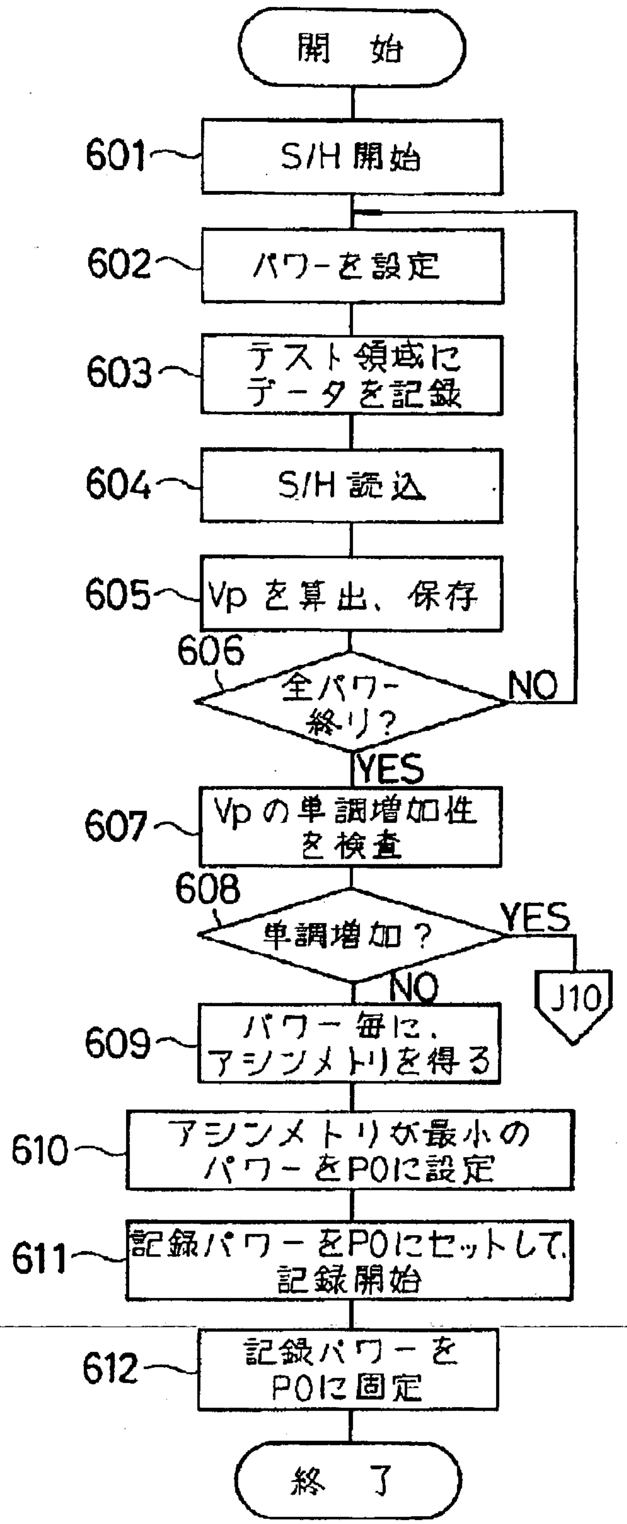
[Drawing 17]


MO
0.012
0.011
0.01
0.009
0.008
0.007
0.006
0.005
0.004
7.5
8.13
8.75
9.38
10
10.63
11.25
11.88
Pw(mW)
N01
N02
N03
N04
N05
N06
N07
N08

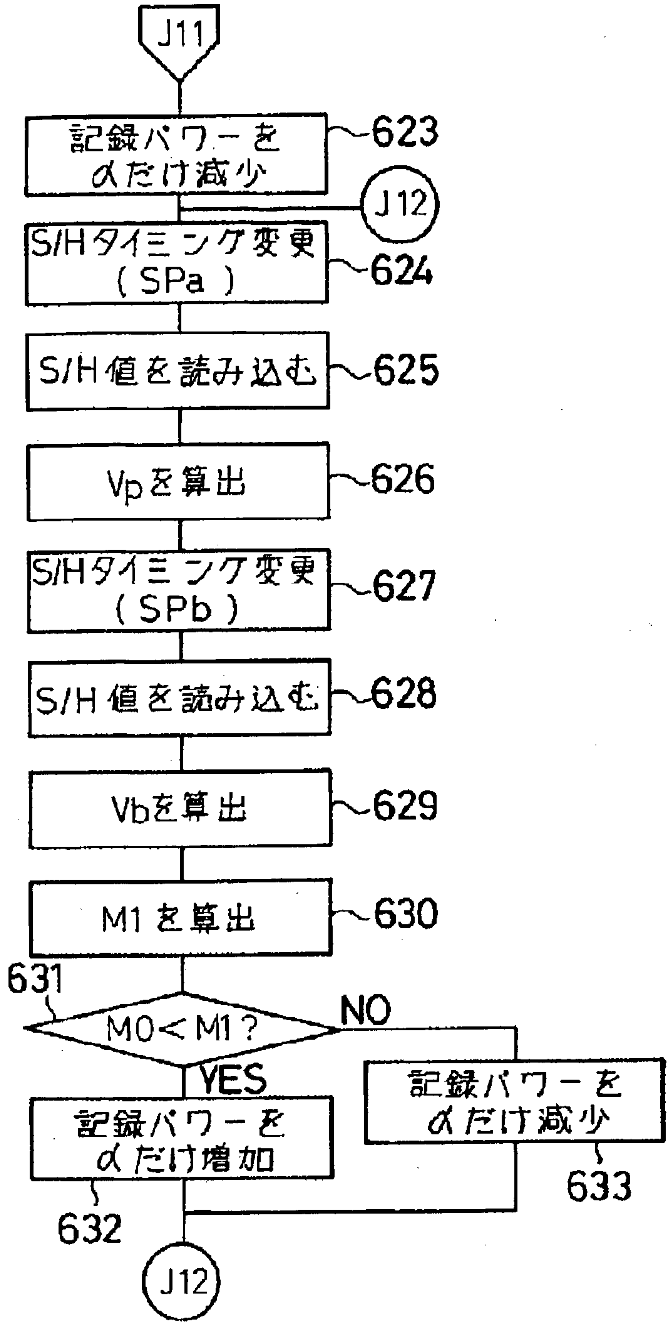
[Drawing 18]


MO
0.008
0.0075
0.007
0.0065
0.006
0.0055
0.005
0.0045
0.004
7.6
8.13
8.75
9.38
10
10.63
11.25
11.88
Pw (mW)
N01
N02
N03
N04
N05
N06
N07
N08

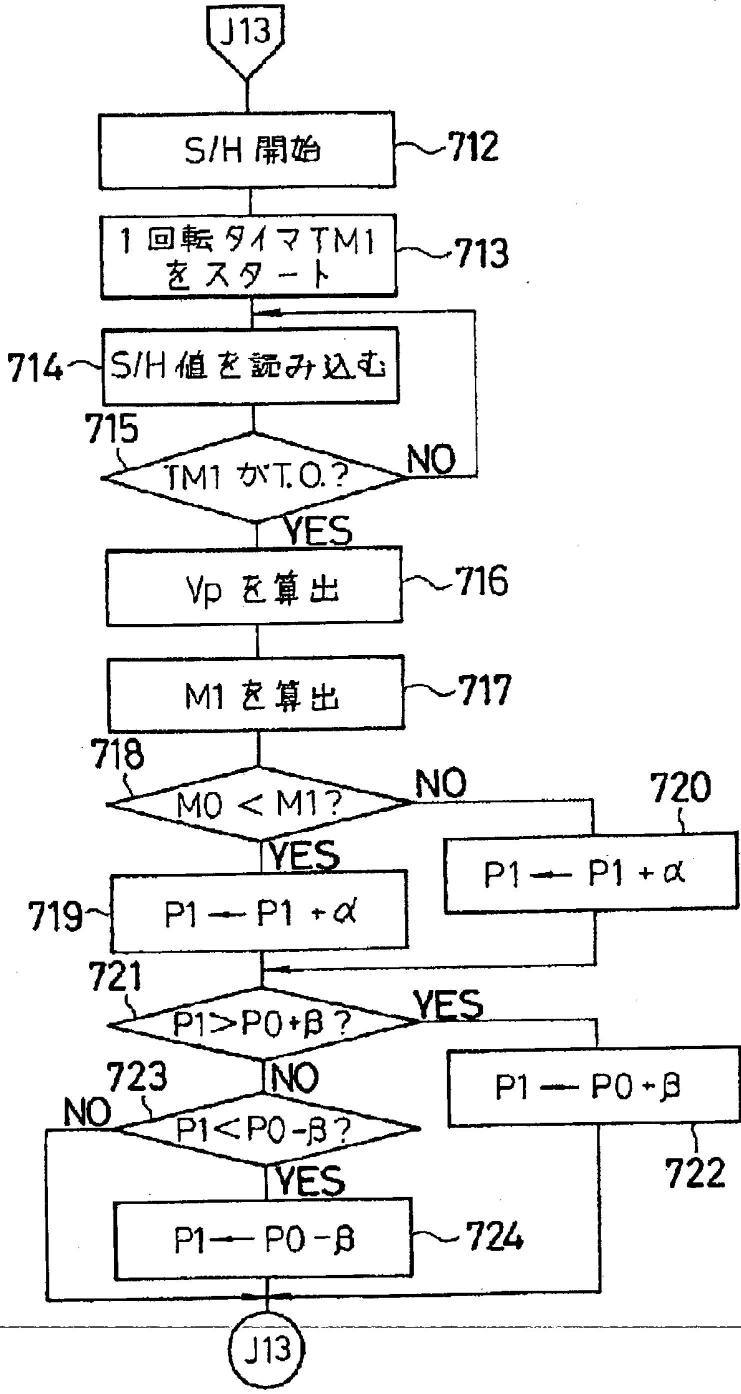
[Drawing 19]


開始
601
S/H開始
602
パワーを設定
603
テスト領域にデータを記録
604
S/H読込
605
Vpを算出、保存
606
全パワー終り?
NO
YES
607
Vpの単調増加性を検査
608
単調増加?
YES
J10
NO
609
パワー毎に、アシンメトリを得る
610
アシンメトリが最小のパワーをP0に設定
611
記録パワーをP0にセットして、記録開始
612
記録パワーをP0に固定
終了

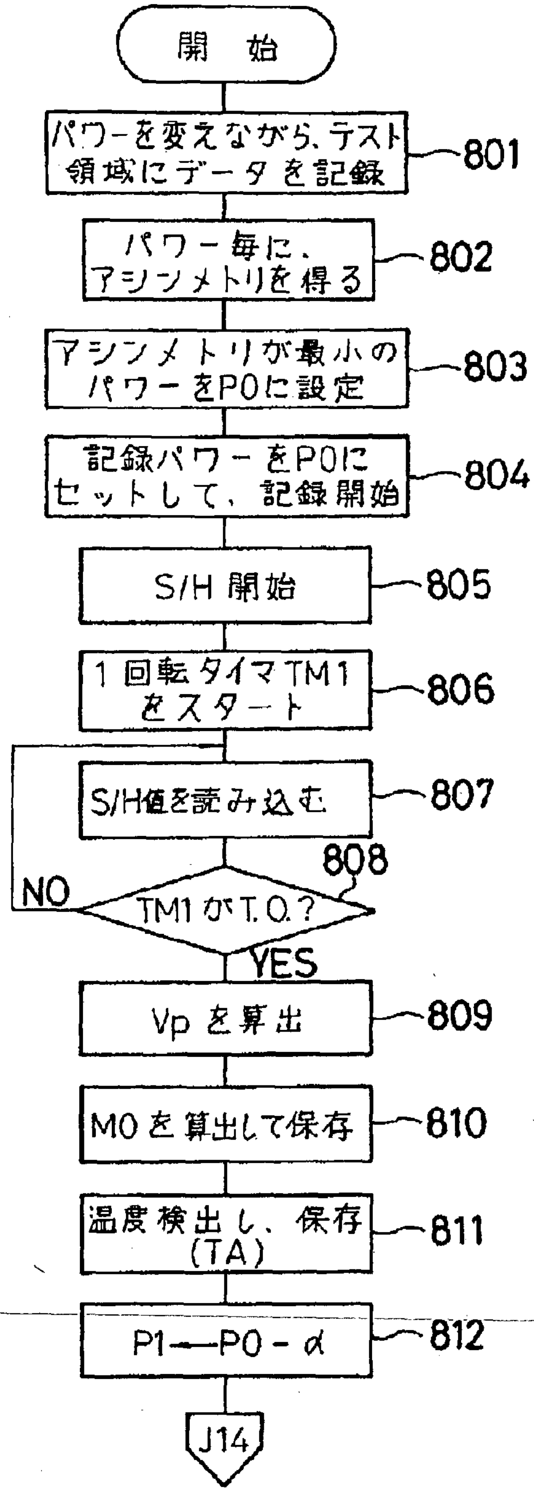
[Drawing 21]


J11
記録パワーを
αだけ減少
623
J12
S/Hタイミング変更
(SPa)
624
S/H値を読み込む
625
Vpを算出
626
S/Hタイミング変更
(SPb)
627
S/H値を読み込む
628
Vbを算出
629
M1を算出
630
631
M0<M1?
NO
YES
記録パワーを
αだけ増加
632
記録パワーを
αだけ減少
633
J12

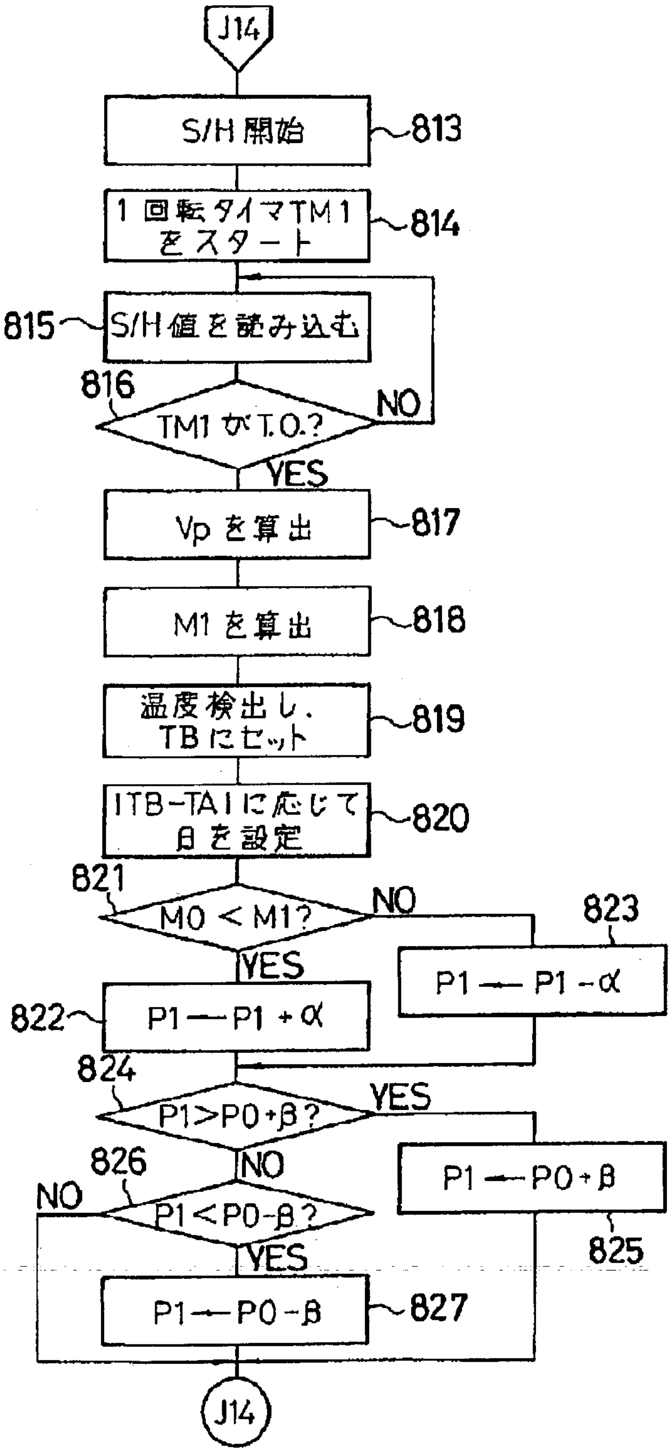
[Drawing 23]


J13
S/H 開始
712
1 回転タイマTM1をスタート
713
714
S/H 値を読み込む
715
TM1 がT.O.?
NO
YES
Vp を算出
716
M1 を算出
717
718
M0 < M1?
NO
720
YES
P1 ← P1 + α
719
P1 ← P1 + α
721
P1>P0+β ?
YES
723
NO
NO
P1<P0-β ?
P1 ← P0 + β
722
YES
P1 ← P0 − β
724
J13

[Drawing 24]


開始
パワーを変えながら、テスト領域にデータを記録
801
パワー毎に、アシンメトリを得る
802
アシンメトリが最小のパワーをP0に設定
803
記録パワーをP0にセットして、記録開始
804
S/H開始
805
1回転タイマTM1をスタート
806
S/H値を読み込む
807
808
TM1がT.O.?
NO
YES
Vpを算出
809
M0を算出して保存
810
温度検出し、保存(TA)
811
P1←P0－α
812
J14

[Drawing 25]



[Translation done.]